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INTRODUCTION

In the course of Operation Crossroads hundreds of civilian and military scientists worked in and about Bikini Lagoon for a period of several months in the spring and summer of 1946. As a result of their efforts, this locale, shown in figure 1, probably was as well known from the standpoint of oceanography as any other similar spot in the world. The significance of the data obtained necessarily was enhanced by the fact that the Bikini area became the site of two atomic explosions. Moreover, the possession of pre-test data concerning physical and biological conditions of Bikini Atoll suggested the very challenging possibility of a post-test comparison.

When scientific information obtained in Operation Crossroads was submitted to the Joint Crossroads Committee, immediate consideration was given to the desirability of making a follow-up investigation in the Summer of 1947, after an anticipated subsidence of radiation effects had taken place, permitting certain desirable types of study and examination, and after sufficient time had elapsed to permit various potential long-range effects to materialize.

At the time of Operation Crossroads, certain questions necessarily had to remain unanswered, either because post-test radiation made desired inspections hazardous, or because the questions were concerned with long-range effects. For example, the problems of how long and in what ways abnormal radioactivity affects the flora and fauna of a region could not be solved immediately.

Inherent in the foregoing problem were questions concerning the persistence of radiation in water, soil, metal, and rock; and the ultimate effects of radiation upon the survival, genetic structure, distribution, and the ecological relationships of aquatic and terrestrial plants and animals. Data concerning such unsolved problems are of great potential value in obtaining an overall picture of permanent or semi-permanent effects brought about by atomic bombs on land and sea areas.

In addition, much remained to be learned about specific types of damage inflicted upon the vessels that sank in Bikini Lagoon. Various instruments went down with the target ships, and had to be recovered before their recordings could be analyzed. Moreover, it was believed that underwater inspection of sunken vessels would yield many facts which would serve to round out and complete the findings of Operation Crossroads, and to point the way for necessary changes in naval policy, tactics and design.

PART I

ORIGIN AND ORGANIZATION OF THE BIKINI SCIENTIFIC RESURVEY

INDEX

1.001 Origin of the Bikini Scientific Resurvey

As suggested in the Introduction to this report, the Joint Crossroads Committee had given thought to the possibility of a Bikini Scientific Resurvey almost as soon as Operation Crossroads was concluded. Certain equipment, sunk in Bikini Lagoon, remained to be recovered; various desired inspections could not be made at the time of Operation Crossroads; and the passage of time was a necessary factor in answering questions concerning the long-range biological and physical effects of radioactivity resulting from detonation of an atomic bomb.

Following the successful conclusion of Operation Crossroads, representatives of the Joint Crossroads Committee made some preliminary investigations relative to the feasibility of a resurvey. These investigations were carried out by Commander Roger Revelle, Head of the Geophysical Branch of the Office of Naval Research, and Dr. E. S. Gilfillan, Jr., Technical Director, Joint Crossroads Committee, who consulted with leading scientists of Joint Task Force One concerning the studies that should be undertaken, and the material support required for the proposed operations. Meanwhile, the Joint Crossroads Committee appointed a Sub-committee under the Chairmanship of Rear Adm. T. A. Solberg, and including Commander Revelle and Dr. Gilfillan, to study proposed operational details and make recommendations. Recommendations were made orally to the Joint Crossroads Committee. The latter organization then made similar proposals to the Joint Chiefs of Staff. Shortly thereafter official action was taken by the Joint Chiefs of Staff, recommending the organization of a Bikini Scientific Resurvey, as detailed in the following section. Commander Revelle acted as Project Officer of this proposed survey until he was relieved by Captain C. L. Engleman, U.S.N., on 13 June 1947.

1.002 Authorization of the Bikini Scientific Resurvey

The Bikini Scientific Resurvey has its official origin in a Joint Chiefs of Staff Memorandum to the Secretary of the Navy, signed Fleet Admiral W. D. Leahy, dated 16 May 1947 which requested that the Joint Crossroads Committee and its successor organization, the Armed Forces Special Weapons Project, undertake technical supervision of such a survey; to be conducted by the Navy Department in cooperation with the War Department, and with participation by the U. S. Geological Survey, the Fish and Wildlife Service of the Department of the Interior, and the National Museum. Fleet Admiral Leahy set a target date of 15 July 1947 for commencing operations at Bikini, and indicated that the resurvey would be for the general purpose of completing "....studies and projects begun in 1946 in connection with Operation Crossroads." This Joint Chiefs of Staff Memorandum is reproduced in Appendix A.

On the same date, Fleet Admiral Leahy forwarded a Joint Chiefs of Staff Memorandum to the Secretary of War, indicating that in accordance with recommendations made by the Joint Crossroads Committee, the Navy Department had been requested to undertake a scientific resurvey of Bikini Atoll, and requesting that the War Department "..cooperate with the Navy... and furnish such facilities and personnel as may be needed..." This Memorandum is included in Appendix A.

The foregoing requests of the Joint Chiefs of Staff were followed on 2 June 1947 by a letter from the Chief of Naval Operations, signed by Vice Admiral Forrest Sherman, and addressed to the Commander-in-Chief, Pacific Fleet, and the Chiefs of the various Bureaus, directing that the Bikini Scientific Resurvey be carried out under operational control of Admiral Louis Denfeld, Commander-in-Chief, Pacific Fleet, and reaffirming the proposed target date of 15 July 1947. This directive further specified that arrangements for supply of special equipment and for assignment of scientific and technical personnel be made by the Bureau of Ships, in

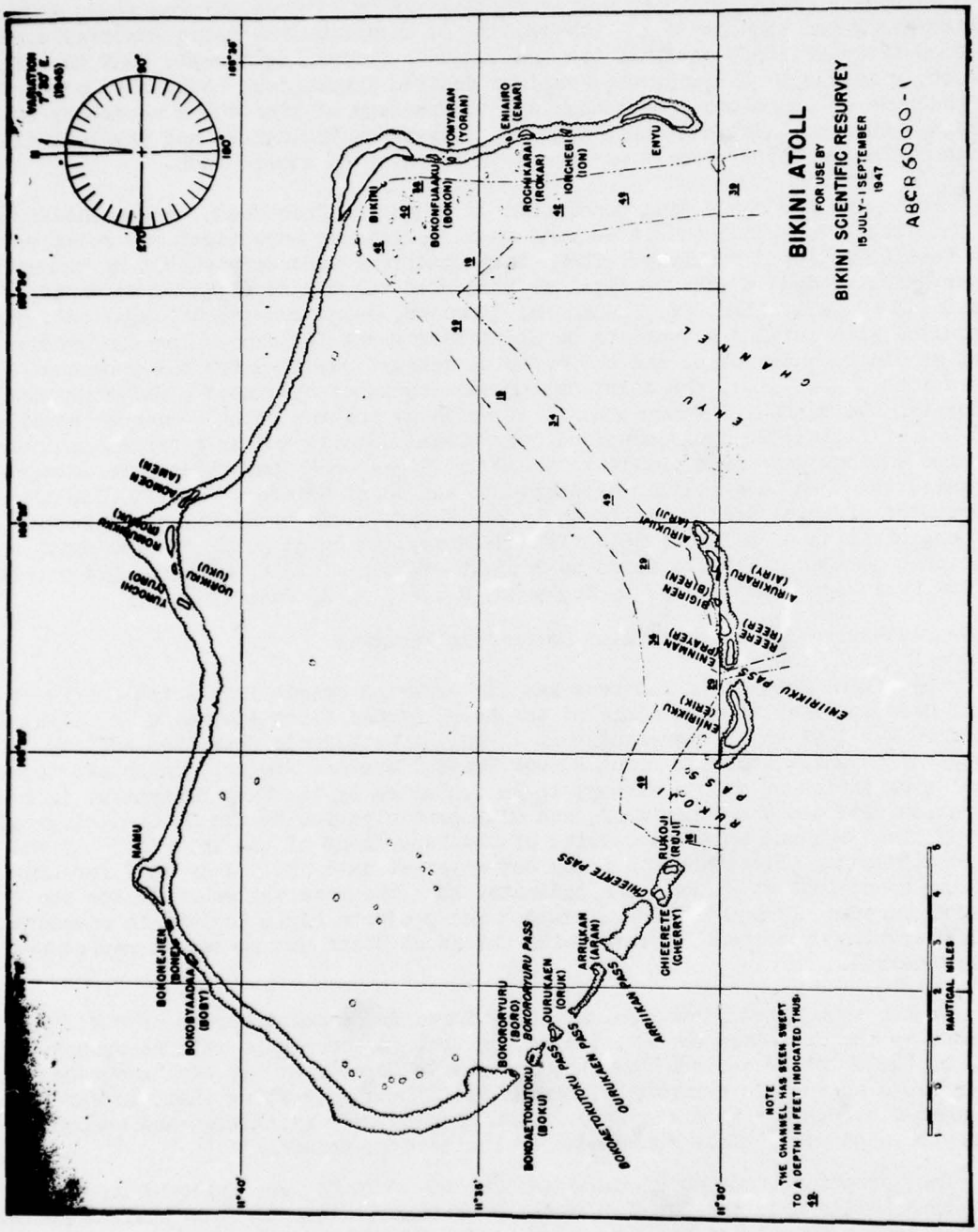

Figure 1. Bikini Atoll, showing islands, Enyu Channel, and passes. Long (Japanese) and short (American) names of islands are given on this map. ABCR Photo No. 6000-1.

cooperation with other offices and bureaus. In addition, the directive reiterated the general purposes of the resurvey, as set forth in the Joint Chiefs of Staff request; confirmed the proposed cooperation with the War Department; assigned technical advice and supervision in planning and conducting the survey to the Joint Crossroads Committee or the Armed Forces Special Weapons Project; and suggested participation by the Atomic Energy Commission, the U.S. Geological Survey, the Fish and Wildlife Service of the Department of the Interior, and the National Museum. The aforementioned directive is reproduced as Appendix B.

1.003 Mission of the Bikini Scientific Resurvey

In his Joint Chiefs of Staff Memorandum to the Secretary of the Navy (Appendix A) Fleet Admiral W. D. Leahy indicated that the Bikini Scientific Resurvey "...would entail the collection of biological specimens; diving on target ships to recover specific instruments and to make certain structural examinations; the taking of water and bottom samples and cores; and radiological studies of the lagoon, the surrounding islands, and organisms, with particular reference to analysis of hazards from alpha radiation and from possibly contaminated food organisms."

Analysis and implementation of this mission was begun at once by the Joint Crossroads Committee, with the result that the following items were listed for specific investigation:

A. The amount and nature of radioactivity remaining in the lagoon water and on the reef and land structures of the atoll, wherever it exceeded normal levels of radioactivity and cosmic rays. Particular attention to be given to that portion of the reef between Amen and Bikini Islands; at a stage of tide as nearly as possible that which existed 15 minutes after Test B, to chart the exposed portion of the reef by use of aerial photography.

B. The concentration and kind of radioactive materials in plants and animals of the area, and the effects of radioactivity upon such organisms.

C. Physiological, geological, and oceangraphic studies of organisms and reef-building processes, including the drilling of cores down to 1,000 and perhaps 2,500 feet.

D. Detailed observations (including photographic recording) of ships sunk as a result of Test B, with special attention to Saratoga, Nagato, Pilotfish, and Apogon, and perhaps Arkansas and Gilliam, time permitting. Detailed structural inspection of the sunken vessels, to determine the exact cause of sinking; and to reveal minor structural failures such as bent, warped, or ruptured plating and scantlings.

E. Recovery of four instruments from Nagato, as follows: one ionization gage, two linear time pressure recorders and one diaphragmtype damage gage. These instruments, being watertight, were believed to be in good condition, and it was thought that their recordings might be of considerable value.

F. Time permitting, to attempt to locate a section of LSM-60, believed to have been identified in photographs, and to inspect this section thoroughly for type of rupture, heat effects, and radioactivity.

Figure 2. The beach on the lagoon side of Enyu Island, 1947. Note wreckage from OPERATION CROSSROADS remaining on the beach. ABCR Photo No. 5025-10.

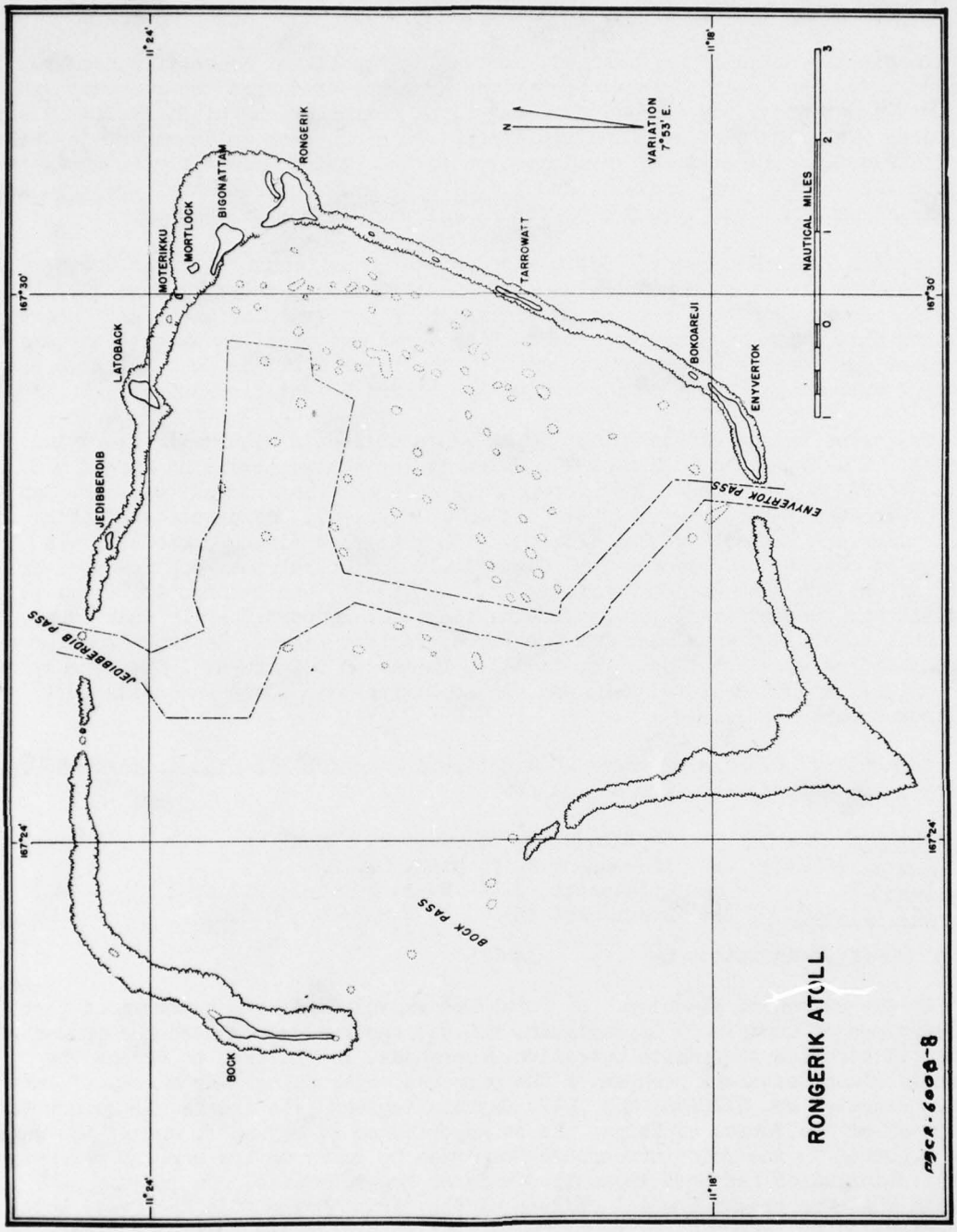

Figure 3. Rongerik Atoll, where studies of the flora and fauna were made in 1947 as a check upon observations at Bikini Atoll. ABCR Photo No. 6000-8.

1.004 Task Force Organization

In his directive of 2 June 1947, activating the Bikini Scientific Resurvey (Appendix B), the Chief of Naval Operations had indicated that the resurvey would be carried out under the operational control of Commander-in-Chief, Pacific Fleet. On 3 June 1947 the Chief of Naval Operations, in a dispatch to Commander-in-Chief, Pacific Fleet, designated for participation in the Bikini Scientific Resurvey the Chilton (APA-38), Coucal (ASR-8), and LCI(L)-615; and requested that Chilton (APA-38) sail from San Diego 1 July 1947 for Bikini Atoll via Pearl Harbor.

Captain T. H. Hederman, U.S.N., was designated as Commander, Task Group 10.12 by a dispatch from the Commander-in-Chief, Pacific Fleet, dated 12 June 1947. Captain Hederman had been serving as Commander, Fleet Training Group and Underway Training Unit, with headquarters at San Diego. He was about to execute permanent change of duty orders and become Commander, Destroyer Flotilla One, but this assignment was delayed until completion of the Bikini Scientific Resurvey.

The organization of Task Group 10.12 was detailed in CinCPacFlt Operation Order No. 101-47, dated 28 June 1947, which is reproduced herein as Appendix C. Chilton (APA-38), Commander Task Group 10.12 embarked was ordered to depart San Diego when in all respects ready for sea on 1 July 1947, and proceed to Bikini Atoll via Pearl Harbor. Coucal (ASR-8), with qualified diving personnel, was ordered to report to Commander Task Group 10.12 for operational control upon arrival of Chilton (APA-38) at Pearl Harbor. LCI(L)-615 was ordered to report by dispatch when ready for sea at Kwajalein. Logistic support for the Task Group was assigned through Commander Service Force, Pacific Fleet. Instructions for communications were detailed. Construction Battalion Detachment 1800, consisting of 1 officer and 36 enlisted men, and one amphibian-type plane was assigned to the Task Group.

Commanding officers of vessels participating in the Bikini Scientific Resurvey on 15 August 1947 were as follows:

Chilton (APA-38)	:	Captain R. W. Lajeunesse, U.S.N.
Coucal (ASR-8)	:	Lieutenant J. E. Reid, U.S.N.
LSM-382	:	Lieutenant (j.g.) R. H. Hughson, U.S.N.
LCI (L)-615	:	Lieutenant (j.g.) W. E. Keeler, U.S.N.

1.005 Staff Organization

In the course of planning, the Joint Crossroads Committee recommended that the services of Captain C. L. Engleman, U.S.N., who had coordinated the Bureau of Ships' electronics program, in Operation Crossroads, be obtained to direct the scientific and technical program of the proposed undertaking. By Bureau of Personnel dispatch No. 212025Z, May 1947, Captain Engleman was ordered to report to the Chief of the Bureau of Ships. He so reported on 27 May 1947, and at the same time reported to the Joint Crossroads Committee to carry on the work of resurvey organization which had been begun by Commander Roger Revelle. On 13 June 1947 Captain Engleman became Project Officer of the Bikini Scientific Resurvey, being so designated by the Chief of Naval Operations in a dispatch to the Commander-in-Chief, Pacific Fleet.

Commander E. S. Gilfillan, Jr., was designated as Technical Director in a Chief of Naval Operations dispatch to Commander-in-Chief, Pacific Fleet, dated 13 June 1947. Commander Gilfillan had been Technical Director of the Joint Crossroads Committee; and had participated in Operation Crossroads, both on the Technical Staff, and as Executive Officer of the former Japanese battleship Nagato.

Staff officers and Heads of Departments as organized by the Project Officer were as follows:

1. Commander Roger Revelle----------Rear Echelon Officer (also at Bikini 15-26 July 1947)
2. Lieutenant Colonel C. E. Grant(Cml.C.)--Radiological Safety Officer
3. Commander J. R, Denny (CEC)----------Construction Officer
4. Commander H. S. Etter (MC)----------Radiological Health Officer
5. Lieutenant Colonel E. C. Paules---------Participating Observer, War Department
6. Lieutenant Colonel G. A. Heffernon(MC)--Participating Observer, War Department(joined at Pearl Harbor)
7. Commander R. S. Brookings----------Administrative Officer and Security Officer
8. Lieutenant Commander F. B. Ewing,U.S.N.-Director of Ship Material
9. Lieutenant Commander F. L. Fitzpatrick--Technical Reports Officer
10. Lieutenant Commander R. L. Reaser-------Administrative Officer for Technical Director; X-Ray Division Officer.
11. Lieutenant Commander W. R. Richardson---Public Information Officer
12. Lieutenant D. M. Carr, U.S.N., (SC)-----Supply Officer
13. Lieutenant James Harper, U.S.N.---------Personnel Officer
14. Lieutenant Robert Givens, U.S.N.--------Participating Observer, Office of Naval Research; Reports, Public Information, and Communications.
15. Captain E. G. Halligan, U.S.A.----------Radiological Safety
16. Lieutenant (j.g.) J. L. Grenier---------Electronics Coordinating Office
17. Lieutenant (j.g.) Arvel Heath ---------Photographic Officer
18. 1st Lieutenant L. N. Chittock, U.S.A.-- Meteorologist (joined at Pearl Harbor)
19. Lieutenant (j.g.) B. D. Lamar----------Radiological Safety
20. Ensign C. A. Sueur----------Radiological Safety
21. Ensign J. T. Watson----------Radiological Safety
22. Ensign F. J. Jablonski----------Aide to Project Officer

23. Ensign B. W. Timmer----------Assistant to Technical Director

24. Ensign W. E. Glenn----------Electronics Assistant

25. 2nd Lieutenant C. B. MacKenzie, U.S.A.--Radiological Safety

26. Ensign William Nivisen----------Radiological Safety

27. Ensign L. G. Timberlake (CEC)----------OinC, CBD 1800 (on board at Pearl Harbor)

1.006 Procurement of Personnel

From the earliest days of organization, it was recognized that the aid of competent civilian scientists would be necessary for successful completion of some tasks involved in the Bikini Scientific Resurvey. As indicated in Section 1.002, technical supervision of this survey had been assigned to the Armed Forces Special Weapons Project which assumed jurisdiction over residual matters of Operation Crossroads when the Joint Crossroads Committee was dissolved on 10 June 1947. At the time of the resurvey, the Armed Forces Special Weapons Project was organized with Major General L. R. Groves as Chief, and Rear Admiral W. S. Parsons as Deputy Chief. This agency cooperated with the Bureau of Ships to secure the necessary scientific and technical personnel for the proposed operations.

Early contacts with civilian scientists were established by Commander Roger Revelle and Commander E. S. Gilfillan, Jr.; the former ultimately becoming Rear Echelon Officer of the Bikini Scientific Resurvey, and attending to last-minute personnel and equipment requirements while Task Group 10.12 was enroute to Bikini. After Captain C. L. Engleman, U.S.N., was assigned to the Project, he supervised much of the work of personnel procurement and of establishing working relationships with participating institutions and agencies.

The net result of these efforts was that, upon arrival at Bikini, and in addition to the fact that the War Department was participating in the resurvey, the following agencies and institutions were represented: Atomic Energy Commission; Clinton Laboratories, Oak Ridge, Tennessee; Colorado School of Mines; Columbia University; Cornell Aeronautical Laboratory; Department of Game, State of Washington; Fish and Wildlife Service, Department of the Interior; Hanford Engineering Works; International Pacific Fisheries Halibut Commission; Ohio State University; Scripps Institution of Oceanography; Stanford University, including Stanford Research Institute and Hopkins Marine Station; U. S. Geological Survey, Department of the Interior; U. S. National Museum, Smithsonian Institution; University of Hawaii; University of Minnesota; University of Tennessee; and University of Washington.

Assignment of enlisted personnel was initiated in a letter from the Chief of the Bureau of Ships to the Chief of Naval Personnel, dated 9 June 1947, and detailing the needs of the proposed operation. The men thus procured, supplemented by a few others subsequently assigned to the project by the Commander-in-Chief, Pacific Fleet, ultimately made up the X-Ray Division, which included 183 enlisted men.

1.007 Scientific Group Organization

For purposes of reporting results and findings, the investigations of the participating scientists and military personnel may be grouped within a number of

relatively broad categories. These Scientific and Military Groups, together with their personnel were as follows on 15 August 1947 (subsequent changes in personnel are noted in Section 2.015):

A. Geology

1. Island and Reef Geology

Dr. H. S. Ladd, Geologist in Charge, Division of Areal Geology, Geological Survey, U. S. Department of the Interior (on board at Bikini).

Dr. J. Harlan Johnson, Professor of Geology, Colorado School of Mines; and Geologist, Geological Survey, U. S. Department of the Interior.

Mr. G. G. Lill, Geophysics Branch, Office of Naval Research (on board at Bikini).

Mr. J. I. Tracey, Geologist, Geological Survey, U. S. Department of the Interior.

Dr. J. W. Wells, Professor of Geology, Ohio State University; and Geologist, Geological Survey, U. S. Department of the Interior.

2. Submarine Geology

Dr. R. D. Russell, Navy Electronics Laboratory, San Diego (on board at Pearl Harbor).

Mr. E. H. Shuler, Navy Electronics Laboratory San Diego.

Work undertaken by the Geology Group included study of the ecology of reef-building organisms such as algae and corals, and the effects of radiation upon them; study of core samples and sediments to determine the extent and nature of radioactivity; and general study of the geological history of Bikini Atoll.

To facilitate the work of the Geology Group, the G. E. Failing Co. was employed under Navy contract to carry on drilling operations. Representatives of this organization in the Bikini Scientific Resurvey were as follows:

Mr. V. C. Mickle, Supervisor (on board at Bikini)

Mr. E. L. Alexander, Engineer (on board at Bikini)

Mr. P. W. Bradfield, Driller

Mr. R. L. Bridgewater, Driller and Supervisor

Mr. N. O. McLemore, Helper and Driller

Mr. J. E. Davis, Helper and Assistant Driller

Mr. J. E. Freeman, Helper

Mr. H. S. Mayberry, Helper

B. Radiobiology

Dr. L. R. Donaldson, Professor of Fishery Biology and Director of Applied Fishery, University of Washington; and Consultant, Atomic Energy Commission.

Mr. R. F. Foster, Associate Scientist, University of Washington; and Supervisor, Biological Laboratory, Hanford Engineering Works.

Mr. L. B. Marquiss, Assistant Scientist, University of Washington.

Mr. R. C. Meigs, Associate Scientist, University of Washington; and Assistant Chief Biologist, Department of Game, State of Washington.

Mr. R. H. Osborn, Assistant Scientist, University of Washington.

Mr. C. F. Pautzke, Associate Scientist, University of Washington; and Chief Biologist, Department of Game, State of Washington.

Mr. J. P. Pflueger, Assistant Scientist, University of Washington.

Dr. F. H. Rodenbaugh, Sr., (M.D.), Consultant, Medical-Legal Board, Atomic Energy Commission.

Mr. F. H. Rodenbaugh, Jr., Assistant Scientist, University of Washington.

Mr. A. H. Seymour, Associate Scientist, University of Washington; and Biostatician, International Pacific Halibut Fisheries Commission.

Dr. A. D. Welander, Associate Scientist and Instructor in Fisheries, University of Washington.

Work undertaken by the Radiobiology Group included study of the incidence of radiation in living forms in and about the atoll; comparative studies of radiation exhibited by representatives of different plant and animal groups; and comparative studies on the distribution of radioactive material in various organs and tissues, especially from the standpoint of using certain organisms as human food. Histological studies of various fish tissues also were begun at Bikini, to be continued at the Applied Fisheries Laboratory, University of Washington.

C. Fisheries

1. Reef and Lagoon Fishes

Mr. V. E. Brock, Collaborator, Fish and Wildlife Service, U. S. Department of the Interior; and Director of the Division of Fish and Game, Territory of Hawaii.

Dr. R. W. Hiatt, Collaborator, Fish and Wildlife Service, U. S. Department of the Interior; and Chairman, Department of Zoology, University of Hawaii (on board at Pearl Harbor).

Mr. R. T. Tuiasosopo, Fisherman, Fish and Wildlife Service, U. S. Department of the Interior (on board at Pearl Harbor).

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Mr. L. B. Marquiss, Assistant Scientist, University of Washington.

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Mr. R. H. Osborn, Assistant Scientist, University of Washington.

Mr. C. F. Pautzke, Associate Scientist, University of Washington; and Chief Biologist, Department of Game, State of Washington.

Mr. J. P. Pflueger, Assistant Scientist, University of Washington.

Dr. F. H. Rodenbaugh, Sr., (M.D.), Consultant, Medical-Legal Board, Atomic Energy Commission.

Mr. F. H. Rodenbaugh, Jr., Assistant Scientist, University of Washington.

Mr. A. H. Seymour, Associate Scientist, University of Washington; and Biostatician, International Pacific Halibut Fisheries Commission.

Dr. A. D. Welander, Associate Scientist and Instructor in Fisheries, University of Washington.

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Mr. R. T. Tuiasosopo, Fisherman, Fish and Wildlife Service, U. S. Department of the Interior (on board at Pearl Harbor).

Mr. L. K. Warner, Fisherman, Fish Wildlife Service, U. S. Department of the Interior (on board at Pearl Harbor).

2. Pelagic Fishes

Mr. J. C. Marr, Aquatic Biologist, Fish and Wildlife Service, U. S. Department of the Interior (on board at Pearl Harbor).

Mr. E. F. Gurley, Commercial Fisherman, Fish and Wildlife Service, U. S. Department of the Interior.

Dr. G. S. Myers, Professor of Biology and Curator of the Zoological Collection, Stanford University.

Mr. R. B. Norton, Commercial Fisherman, Fish and Wildlife Service, U. S. Department of the Interior.

Dr. O. R. Smith, Aquatic Biologist, Fish and Wildlife Service, U. S. Department of the Interior.

Mr. R. Uithof, Commercial Fisherman, Fish and Wildlife Service, U. S. Department of the Interior.

3. Population and Taxonomic Studies

Dr. L. P. Schultz, Curator of Fishes, U. S. National Museum, Smithsonian Institution.

Investigations proposed by the Fisheries Group included population studies of reef, lagoon, and pelagic fishes, to be contrasted with similar studies made prior to Test A and Test B; studies of food habits in relationship to fission products; studies of reproductive abnormalities of possible radiological origin; and studies of taxonomy. In addition, it was understood that Dr. Schultz would provide an identification service for the Radiobiology Group.

D. Biology

1. Experimental Biology

Dr. D. M. Whitaker, Dean, Department of Biology, Stanford University.

Dr. L. R. Blinks, Director of Hopkins Marine Station, Stanford University (on board at Bikini).

Dr. P. M. Brooks, Associate Plant Physiologist, Stanford Research Institute, Stanford University.

Mr. T. F. Goreau, Assistant Oceanographer, Scripps Institution of Oceanography.

Dr. W. A. Gortner, Associate Scientist, Scripps Institution of Oceanography.

Dr. G. M. Smith, Professor of Botany, Stanford University.

2. Ecology and Morphology

Dr. J. P. E. Morrison, Associate Curator of Mollusks, U. S. National Museum, Smithsonian Institution.

Mr. F. M. Bayer, Assistant Curator of Marine Invertebrates, U. S, National Museum, Smithsonian Institution.

Dr. A. C. Cole, Professor of Zoology and Entomology, University of Tennessee.

The Experimental Biology Group undertook to study possible radiological effects upon the development of invertebrates, and the physiology of marine and other plants, emphasis being upon pigmentation, calcium deposition, permeability, cell sap, bioelectric phenomena, respiration, and photosynthesis, comparing organisms subjected to radiation effects with normal types; and studies concerned with chemical factors in sea water, with special reference to organic production and calcium deposition.

The Ecology and Morphology Group conducted taxonomic studies of land animals, birds, and marine animals; ecological zoning studies; taxonomic studies of calcareous, reef-building algae; and comparison studies of species abundance, with special reference to changes in population or morphology represented in the Crossroads target area.

E. Radiochemistry and Radiophysics

1. Fission Products Chemistry

Dr. R. R. Williams, Assistant Professor of Chemistry, University of Notre Dame (on board at Bikini).

Dr. D. M. Black, Research Associate, Massachusetts Institute of Technology (on board at Bikini).

Mr. R. R. Edwards, Research Associate, Massachusetts Institute of Technology (on board at Bikini).

Mr. L. E. Glendenin, Research Associate, Massachusetts Institute of Technology (on board at Bikini).

Dr. W. H. Hamill, Associate Professor of Chemistry, University of Notre Dame (on board at Bikini).

2. Plutonium Chemistry

Dr. Jack Schubert, Assistant Professor of Physiological Chemistry, University of Minnesota (on board at Bikini).

Mr. D. P. Ames, Research Assistant, University of Wisconsin (on board at Bikini).

Mr. M. T. Walling, Argonne National Laboratory (on board at Bikini).

3. Soils Chemistry

Dr. L. F. Seatz, Assistant Professor of Agronomy, University of Tennessee (on board at Bikini).

4. Radiophysics

Dr. J. H. Roberson, Physicist, Clinton Laboratories, Oak Ridge, Tennessee.

Mr. F. M. Simons, Physicist, Bartol Research Foundation.

It was the function of the Radiochemistry and Radiophysics group to investigate the presence and dispersal of plutonium and fission products; to study the vertical distribution of radioactivity in the rocks; and generally to carry on counter-room activities.

F. Radiological Safety

Lieutenant Colonel C. E. Grant

Mr. P. T. Ellard, Radiological Monitor, Scripps Institution of Oceanography.

First Lieutenant E. G. Halligan, U.S.A.

Lieutenant (j.g.) B. D. Lamar

Ensign C. A. Sueur

Ensign J. T. Watson

Second Lieutenant C. B. Mackenzie, U.S.A.

Ensign William Nivisen

As implied by the name, it was the function of the Radiological Safety Group to conduct monitoring operations, to assure the radiological safety of all hands, and to prevent contamination of ships.

G. Radiological Health

Commander H. S. Etter (MC)

3 Pharmacist's Mates

The function of the Radiological Health Group was to conduct pre-operation and post-operation medical examinations of personnel; and generally to assure radiological health of all hands.

H. Diving, Underwater Photography and Television

Lieutenant Commander F. B. Ewing, Director of Ship Material (on board at Pearl Harbor).

Lieutenant J. E. Reid, U.S.N. Commanding Officer of Coucal (ASR-8)

Mr. J. P. Gould, Engineer, Cornell Aeronautical Laboratory.

Lieutenant (j.g.) Arvel Heath, Photography Officer

Mr. R. E. Frazier, Engineer, Cornell Aeronautical Laboratory.

Radiological Safety Officer as assigned.

The function of the Diving and Underwater Photography Group was to inspect and photograph sunken ships, to carry out detailed examination of ships' structures, and to effect recovery of certain instruments on sunken ships. A related task was to provide shallow-water black-and-white and color photographic service for the various Scientific Groups. In the course of the resurvey experimental underwater television equipment was tried out on Coucal (ASR-8).

I. Army Engineers

Lieutenant Colonel E. C. Paules, Participating Observer, Corps of Engineers, U. S. Army.

Mr. J. F. Tarpley, Participating Observer, Corps of Engineers, U. S. Army.

Studies carried out by this group were concerned with the general effects of atomic blast, equipment necessary for engineering projects in contaminated areas, and methods of preventing spread of contamination--with special reference to watersheds.

J. Aerology

First Lieutenant L. N. Chittock, U.S.A.

1 Aerographer

It was the function of this group to make detailed weather observations and maintain a weather log, to be used by Air Weather Service in determining the reliability of weather predictions for the Bikini Area.

1.008 Procurement of Equipment

Procurement of necessary equipment for the Bikini Scientific Resurvey presented a problem of considerable magnitude, because available time was sharply limited, and the various types of gear and supply had to be assembled from widely dispersed centers. The work of procurement was carried out by the Bureau of Ships, in keeping with the Chief of Naval Operations directive cited in Section 1.002. Direction of procurement was under general supervision of the Project Officer. Many of the details thereof--especially those concerned with general stores, special clothing and ships' store stock--were dealt with directly by the Supply Officer, Lieutenant D. M. Carr, U.S.N.

The highly technical nature of much of the equipment and gear made it essential that specialists in particular areas of investigation take part in procurement activities. Thus Commander J. R. Denny (CEC) assisted in the selection of construction and camp equipment and supplies obtained through the Bureau of Yards and Docks. Similarly, Commander H. S. Etter (MC) mediated the acquisition of various Bureau of Medicine and Surgery items concerned with radiological health. Lieutenant (j.g.) J. L. Greiner took part in the assembling of electronic apparatus from activities under cognizance of the Bureau of Ships, including Navy Electronics Laboratory, San Diego; and Mr. J. H. Roberson aided in obtaining certain

electronic gear from Clinton Laboratories, Oak Ridge, Tennessee. Underwater photographic equipment and diving gear was obtained by Lieutenant Commander F. B. Ewing, through the Bureau of Ordnance, from Explosive Ordnance Disposal Unit, Indian Head (Md.) Powder Factory, and surface photographic gear was procured by Lieutenant (j.g.) Arvel Heath from the Bureau of Aeronautics. In addition, a limited number of items of various types were obtained from commercial sources through open purchase.

All of the foregoing scientific apparatus, including electronic, chemical, zoological, botanical, ecological, oceanographic, and geological items; all technical and general supplies; and certain types of apparatus and supply which were the personal property of participating scientists or the institutions which they represented, were assembled at San Diego, for loading aboard Chilton (APA-38) prior to 1 July 1947. Meanwhile Coucal (ASR-8) was at Pearl Harbor where the Director of Ship Material was supervising preparations for diving.

General stores were obtained from Naval Supply Depot, San Diego, and Naval Supply Center, Pearl Harbor. Certain additional items deemed to be necessary after underway organization of operation plans and work parties, were supplied by Commander-in-Chief, Pacific Fleet. Total weight of supplies and gear loaded aboard Chilton (APA-38) was approximately 4,480,000 pounds. After departure from Pearl Harbor, logistic support was through Commander Service Force, Pacific Fleet, as indicated in Appendix C, pg. 2.

1.009 Early Planning

It has been indicated previously that informal planning for a Bikini Scientific Resurvey began almost as soon as the Joint Crossroads Committee received the Operation Crossroads report.

A number of staff and committee meetings were held by Armed Forces Special Weapons Project after the dissolution of the Joint Crossroads Committee. A meeting on 16 June 1947, for example, was attended by representatives of the Atomic Energy Commission, Armed Forces Special Weapons Project, Army Chemical Corps, Army Corps of Engineers, Army Signal Corps, and the Chief of Naval Operations. At this meeting progress in planning was reviewed, and the mission of the proposed survey analyzed. Assignment of Army personnel to the Bikini Scientific Resurvey as active participants and as participating observers was discussed.

The foregoing and other similar meetings had a great deal to do with policy formation, procurement of material, and selection of personnel, as detailed in Sections 1.006, 1.007, and 1.008.

Captain T. H. Hederman, U.S.N. was relieved as Commander, Fleet Training Group and Underway Training Unit, San Diego on 18 June 1947, and on the following day reported in Washington to the Chief of Naval Operations for temporary additional duty, and to the Deputy Chief, Armed Forces Special Weapons Project. Between 19 June 1947, and 25 June 1947, he held conferences with the Project Officer and the Rear Echelon Officer, in which general and detailed elements of the task to be performed were outlined. Captain Hederman departed Washington for San Diego on 25 June 1947, where he hoisted broad command pennant in Chilton (APA-38).

PART II

OPERATIONS

2.001 Operations at San Diego

Chilton (APA-38) had recently undergone navy yard overhaul at San Francisco Naval Shipyard; had operated for a brief time as Flagship of Commander, Amphibious Group One, and subsequently under the Retraining Command. On 15 June 1947, Captain R. W. LaJeunesse, USN, reported to Commandant, Eleventh Naval District, prepared to load Chilton (APA-38) for the Bikini Scientific Resurvey.

Chilton (APA-38) was docked at Naval Station, San Diego, and loading operations were begun. The first representatives of the Bikini resurvey group, including the Technical Director, came aboard on 17 June 1947. Construction of required laboratory facilities (described in Section 2.006) was begun at once. Stores began to arrive on 23 June 1947, and from that date until 1 July 1947, loading operations continued both by day and by night. The Project Officer arrived aboard Chilton (APA-38) on 24 June 1947, and civilian scientists and Staff Officers continued to report, until at 0600, 1 July 1947, Chilton (APA-38), Commander Task Group 10.12 embarked, scientific and staff personnel aboard, loaded, and in all respects ready for sea, departed San Diego and proceeded to Pearl Harbor, as directed by Commander-in-Chief, Pacific Fleet, in Operation Order No. 101-47 (see Appendix C).

2.002 Operations at Pearl Harbor

Chilton (APA-38) arrived at Pearl Harbor on 7 July 1947, and docked at the Navy Yard. Fuel, water, and stores were taken aboard. Generators, a picket boat, a DUKW, and some diving gear for Coucal (ASR-8) were loaded, as well as miscellaneous items desired by scientific personnel and ordered by dispatch while Chilton (APA-38) was at sea.

Commander Task Group 10.12, the Project Officer, the Technical Director, and a group of leading scientists called upon officials of Commander-in-Chief, Pacific Fleet, on 7 July 1947. On the same day the Technical Director spoke before the senior officers of Oahu Command Staffs, his subject being the objectives of the Bikini Scientific Resurvey.

Coucal (ASR-8) departed Pearl Harbor enroute Bikini on 7 July 1947, as directed by Commander, Task Group 10.12. Chilton (APA-38), having completed loading and taken aboard additional scientific personnel scheduled to join the Bikini Scientific Resurvey at this point, and being in all respects ready for sea, departed Pearl Harbor enroute Bikini on 8 July 1947.

Lieutenant (j.g.) Arvel Heath was left at Pearl Harbor for an emergency appendectomy. He rejoined Task Group 10.12 at Bikini Atoll on 21 July 1947.

2.003 The Operation Plan

An Operation Plan was prepared by Commander, Task Group 10.12, while Chilton (APA-38) was enroute San Diego to Pearl Harbor. In this plan were incorporated 16 Annexes, detailing various phases of the proposed operation. The Operation Plan, together with its annexes, is reproduced in this report as Appendix D.

The principal provisions of the Operation Plan may be analyzed as follows:

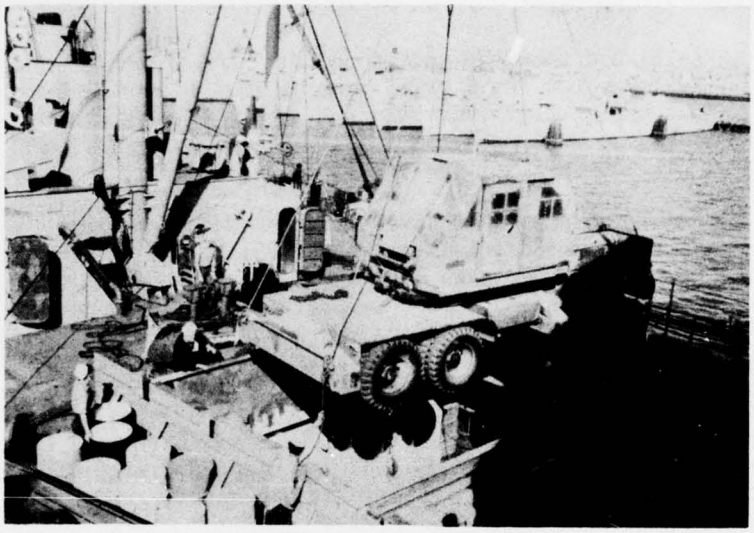

Figure 4. Mobile truck-type crane being loaded aboard CHILTON (APA-38) at San Diego. ABCR Photo No. 5000-10.

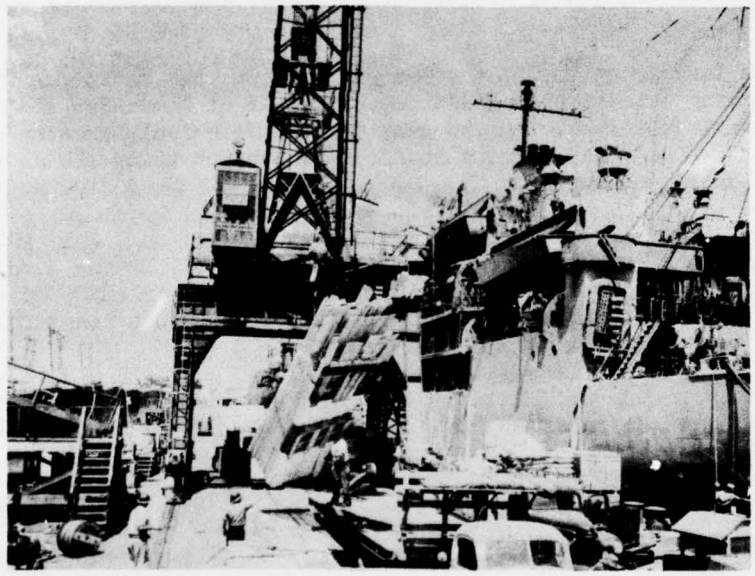

Figure 5. Yard crane hoisting lumber aboard CHILTON (APA-38) at San Diego. ABCR Photo No. 5001-10.

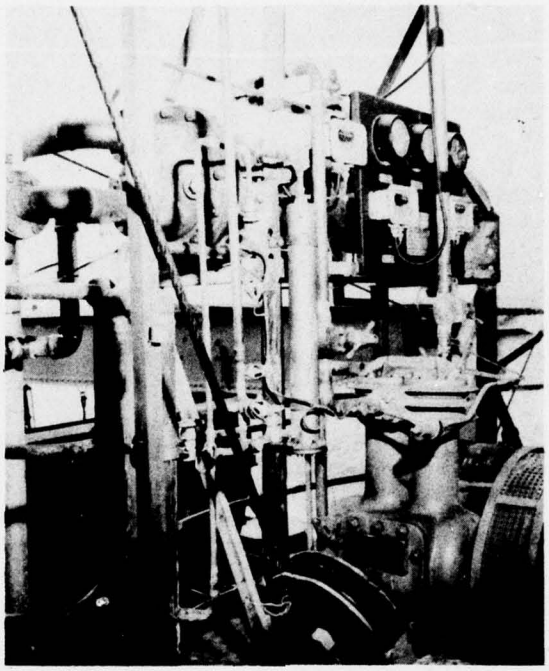

Figure 6. Air conditioning unit installed on boat deck of CHILTON (APA-38) at San Diego, in order to maintain constant humidity in the Counter Room. ABCR Photo No. 5003-2.

A. Task Organization

1. Task Group 10.12, Bikini Resurvey Group, Captain T. H. Hederman, U.S.N.

Chilton (APA-38) Flagship	1 APA
Coucal (ASR-8)	1 ASR
LCI (L)-615	1 LCI(L)
CB Detachment 1800	1 CBD
One Amphibious Type Plane	

2. Task Group 10.12 to carry out technical and scientific phases of the Bikini Scientific Resurvey as directed by ComTaskGroup 10.12 and/or the Project Officer in Chilton (APA-38), in accordance with plans set forth in Annexes.

B. Annex A: Movement Plan

1. Chilton (APA-38) to depart San Diego 1 July 1947 and proceed to Bikini Atoll via Pearl Harbor; to arrive at Bikini 15 July 1947.

2. Coucal (ASR-8) to depart Pearl Harbor so as to arrive at Bikini Atoll 15 July 1947.

3. LCI(L)-615 to depart present base in time to arrive Bikini Atoll 15 July 1947 (Later modified to permit LCI(L)-615 to load supplies at Kwajalein and arrive Bikini on 17 July 1947).

C. Annex B: Resurvey Plan

1. Mission: To observe, measure, and record all significant effects of Operation Crossroads on the organisms of Bikini Atoll and surrounding waters, on the atoll itself, and on ships and equipment remaining from Operation Crossroads; and to contribute to the body of fundamental science by observation, measurement and report on those aspects of oceanography, geology, biology, and nuclear physics that are of particular significance in this locale.

2. Technical organization set up as follows:

Captain C. L. Engleman, Project Officer, U.S.N.
Commander E. S. Gilfillan, Technical Director
Lieutenant Commander F. B. Ewing, Director of Ship Material
Lieutenant Colonel C. E. Grant, Radiological Safety Officer
Commander H. S. Etter, Radiological Health Officer
Lieutenant Commander F. L. Fitzpatrick, Technical Reports Officer
Commander R. S. Brookings, Administrative and Security Officer

D. Annex C: Technical Plan

1. Scientific groups were listed, and it was specified that these groups should report to the Technical Director on all matters directly affecting their scientific work. They were directed to keep the Technical Director constantly informed of plans and progress and of any unusual or unexpected fact or circumstance observed. Scientific Groups were further directed to submit in writing any interim

reports required by the Technical Director, and to submit final individual or group reports to the Chief of the Armed Forces Special Weapons Project.

2. It was specified that the Technical Director would make available to the Technical Reports Officer all data received, excepting such items that might permit accurate calculation of the weight, composition, efficiency, and mechanism of the Test A and Test B bombs.

E. Annex D: Sunken Ship Inspection Plan

1. The Director of Ship Material to make detailed inspections of ships sunk in the course of Operation Crossroads, with special attention to Saratoga, Nagato, Gilliam, and Apogon; and similar inspection of Arkansas and Pilotfish, time permitting.

2. Underwater photographs to be taken of sunken vessels, and underwater television to be used to permit surface observation of sunken hulls.

3. Four instruments referred to in Section 1.003 to be recovered from Nagato, if possible; and an attempt made to locate and inspect a portion of LSM-60.

F. Annex E: Electronics Plan

1. The Electronics Coordinating Officer was assigned responsibility for (a) procurement, installation, maintenance, and repair of all communication equipment under cognizance of the Project Officer; (b) installation, maintenance, and repair of special electronic devices used in scientific work under cognizance of the Technical Director; and (c) giving assistance in installation, maintenance, and repair of television and diver voice-circuits under cognizance of the Director of Ship Material.

G. Annex F: Communication Plan

1. Plan for short-distance communications among ships, shore stations, and boats was detailed.

2. Chilton (APA-38) to take radio guard for all ships-in-company. All traffic addressed to agencies without the resurvey area to be relayed via the Flagship.

3. Messages of higher security classification than Restricted over voice-circuits were prohibited; it was specified that inter-ship messages of such security classification be sent encrypted by radio, visual, guard-mail, or messenger.

4. It was specified that Chilton (APA-38) would guard International Distress Frequency of 500 kc in accordance with existing communication instructions; and that inter-ship communications underway be by visual or TBS on 72.1 mc.

H. Annex G: Technical Logistics Plan

1. Participating individuals and agencies were requested to provide their own special equipment and materials whenever practicable and appropriate.

2. It was specified that all shore-based units be provided with individual equipment, housekeeping equipment, organization equipment, and maintenance supplies for 45 days.

3. Each officer and civilian scientist participating to be issued a quantity of clothing for use in the field and while engaged on special projects.

4. All necessary equipment and supplies to be transported to the Bikini area in the initial movement insofar as possible. Courier service to be maintained between Bikini and Kwajalein by one amphibious type plane, for purposes of transporting personnel, mail, and special freight.

5. A boat pool was provided for under control of the Boat Officer of Chilton (APA-38), to maintain ship-to-ship, ship-to-shore, and specialized operations.

6. It was specified that construction on Bikini would be limited to that necessary for the SeaBee Detachment, the Drilling Group, the Geology Group, recreational facilities, and other special projects authorized by the Project Officer.

I. Annex H: Security Plan

1. This plan listed authority for security regulations, and specified that individuals having access to restricted material, as defined by the Atomic Energy Act, must be cleared in accordance with Public Law 585.

2. Quotations from Joint Chiefs of Staff paper 1552/78, approved 21 November 1946, were included in this plan to indicate specific security classification of many items.

3. Special provisions concerned with photography, instrument and damage data, safety and health information, and communications were included in this plan.

4. It was specified that upon termination of duty with the Bikini Scientific Resurvey each participant would be guided as to what he might discuss by Army and Navy regulations, and by the Atomic Energy Act of 1946.

J. Annex I: Photography Plan

1. This plan provided for photographic service to aid the Project Officer in carrying out his mission, and to enable Scientific Groups to obtain pictorial records.

2. Methods used in identifying film for the record, and in recording data pertaining thereto, were detailed in this plan.

K. Annex J: Radiological Safety and Health Plan

1. This plan defined the functions of the Radiological Health Section and the Radiological Safety Section, and set up an advisory board including the following members.

   Commander H. S. Etter (MC)
   Lieutenant Colonel C. E. Grant (Cml. C.)
   Doctor F. H. Rodenbaugh (M.D.)
   Doctor J. H. Roberson

2. The mission of the Radiological Health and Safety organization was defined as that of protecting personnel from radiological health hazards.

3. Appendix I: Radiological Health Plan

   (a) Radiological hazards were defined, and estimates of residual radioactivity in the Bikini area were made.

   (b) It was provided that special pre- and post-survey medical examinations would be given to all personnel.

   (c) Issue of special clothing to personnel working in contaminated areas was provided for.

   (d) Special regulations for working parties, shore-based personnel, and Scientific Groups were detailed; and the eating of foods and drinking of water found on islands, and swimming in the lagoon were prohibited pending radiological clearance. Provision was made for a Radiological Safety Officer to accompany all initial trips to various areas.

   (e) Special provisions were included for personnel engaged in diving activities, because of anticipated radioactivity in the vicinity of the bomb crater resulting from Test B. It was provided that deep-water survey probes would be employed to determine the extent of radiation prior to a diver's descent, that all diving gear would be washed down and further decontamination (if necessary) after use, that divers would be monitored and decontaminated if necessary, and that all personnel handling diving gear would be protected in the same manner. Similar measures were prescribed for protection of shallow-water divers.

   (f) It was specified that the Type 263 Geiger tube survey meter would be used to detect beta and gamma radiation in the field, that the portable "Zeuto" nylon window ionization chamber would be employed to detect heavy alpha radiation, that the Type 235 survey meter with ionization chamber in an extended probe (gamma radiation) would be used on sunken ships, and that the pencil type quartz fiber dosimeter (gamma radiation) would be employed by divers and other personnel as dictated by circumstances.

(g) This plan provided for establishment of a photographic dosimetry unit to process film badges. It was specified that all divers and other personnel encountering significant radiation would wear Type K film badges, and that an individual would not be allowed to re-engage in the same activity if total body radiation of 0.1 r. per day had been exceeded the previous day.

(h) Provision was made for establishment of decontamination or "change stations", and methods of decontaminating personnel and clothing were outlined.

(i) Rules were outlined for handling radiologically active scientific specimens, for the conduct of laboratory work, and for the disposal of laboratory wastes. These rules were designed to prevent ship contamination.

4. Appendix II: Radiological Safety Plan

(a) The mission of the Radiological Safety Section was defined as one of determining radiological hazard within a given area, and providing the Radiological Health Officer with data permitting an accurate evaluation of the radiological situation.

(b) Proposed monitoring operations with respect to the preliminary survey of Bikini Island, diving operations, core sampling, and other activities were detailed.

(c) Measures to be taken for the protection of personnel were outlined, with special attention to the wearing of film badges, the wearing of protective clothing, and decontamination.

(d) It was provided that files of monitoring reports would be kept by the Radiological Safety Section, and that additional data would be compiled, as required by the Project Officer.

L. Annex K: Re-Entry Plan

1. The re-entry plan outlined procedures to be carried out upon arrival of Task Group 10.12 at Bikini Atoll, including dispatch of an advance landing and reconnaissance party to Bikini Island.

2. Provision (including a priority list) was made for off-loading cargo from Chilton (APA-38); a schedule being included for the period from 15 July 1947 to 22 July 1947.

M. Annex L: Public Information Plan

1. General objectives of the Public Information program, and appropriate security considerations were reviewed.

2. Methods of obtaining release on press summaries, still photographs, and motion pictures were detailed.

N. Annex M: Boat Pool Plan

1. A Bikini boat pool was established under direction of the Commanding Officer of Chilton (APA-38). The mission of this boat pool was

defined as that of providing ship-to-ship, ship-to-shore, and other special boat operations required in support of the project.

2. Three picket boats, 6 PPB's, 8 LCPL's, 2 LCM's, 6 LCVP's, 1 DUKW, 1 MWB, and 4 wherries were assigned to the Boat Pool.

3. Duties of the Boat Pool Officer were detailed, as well as a plan for allocating boats to the various Scientific Groups.

4. Appendix I: Boat Communications

(a) Provision was made for equipping each boat with a radio transmitter-receiver capable of voice communication.

(b) Reports to be made to Guard Ship by boat parties were detailed.

(c) Special provisions were made for boats going beyond a ten-mile radius from Guard Ship.

O. Annex N: Technical Reports Plan

1. It was specified that required information would be made available to the Technical Reports Officer by the Technical Director, and that other information would be obtained in conference with the Task Group Commander, the Project Officer, the Heads of Departments, and the leaders of Scientific Groups.

2. It was specified further that the Technical Reports Officer would prepare portions of the Technical Report dealing with the origin, authorization, mission, operations, and organization of the Bikini Scientific Resurvey; and edit and incorporate into the Technical Report the various reports of Scientific Groups and Heads of Departments.

P. Annex O: Typhoon Plan

1. This annex outlines measures to be taken upon execution of the following typhoon plans: Able, Baker, and Charlie.

2. Measures are also outlined to provide for the safety of boats in heavy weather.

Q. Annex P: Administrative Plan

1. Duties of the Administrative Officer were outlined as follows:

(a) To implement orders of the Project Officer in matters pertaining to the Administration of the Bikini Scientific Resurvey Staff.

(b) To coordinate administrative services in the various Staff Departments.

(c) To maintain liaison with CTG 10.12, the Project Officer, and Commanding Officers of vessels in the Task Group.

(d) To organize and supervise the Project Office.

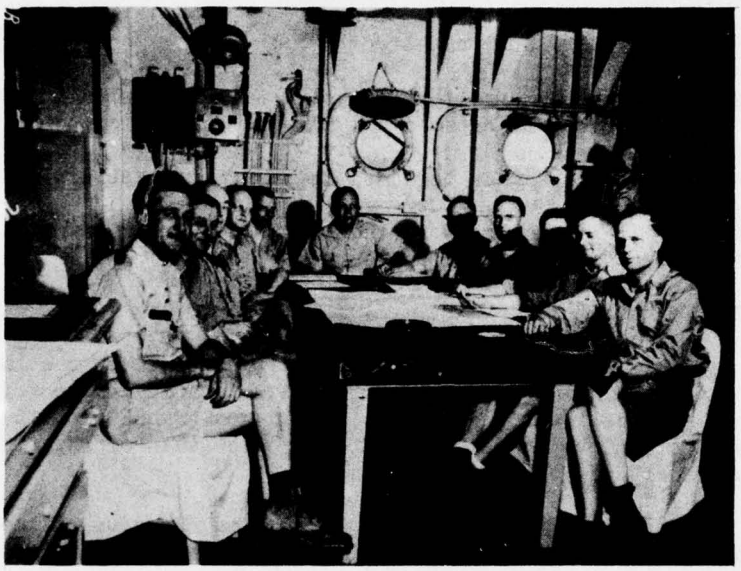

Figure 7. The Project Officer and the Heads of his Staff Departments. Left to right: LTJG J.L. GREINER, LCDR F.L. FITZPATRICK, CDR J.R. DENNY, CDR H.S. ETTER, CDR E.S. GILFILLAN, CAPT C.L. ENGLEMAN, CDR R.S. BROOKINGS, LTCOL C.E. GRANT, LCDR F.B. EWING, LCDR W.R. RICHARDSON, LT D.M. CARR. Standing: ENS F.J. JABLONSKI, Aide to the Project Officer. ABCR Photo No. 5012-2.

2.004 Staff Conferences and Planning

Upon departing San Diego on 1 July 1947, the Project Officer instituted a series of daily conferences with the Heads of Departments on his Staff (see Section 1.005). On various occasions Commander, Task Group 10.12 participated in these meetings, as did the Commanding Officer of Chilton (APA 38), and Commander G. E. Marix, Executive Officer of Chilton (APA 38).

Early conferences were concerned with organization and indoctrination of the Scientific Staff for the work to be done, and with problems of providing adequate plans and facilities for such work. Thus early in the outbound voyage the Project Officer, with the aid of his Department Heads, prepared a mimeographed statement for the general information of the Staff, which included the following data: identities of the Task Group Commander, the Project Officer, the Commanding Officer of Chilton (APA 38), and the Department Heads; functions of the Administrative Officer; description of Chilton (APA 38) including the location of facilities; procurement of needed equipment and supplies; matters pertaining to postal address, money, and checks; the mess schedule; berthing; medical and dental service; roster of scientific personnel; roster of Staff Officers; photographic services; security; public relations; the Technical Report, location and facilities of repair shops; communications; radiological health and safety precautions; issue of special clothing; ship's telephone directory; organization of the Task Group; and recreation facilities. A similar indoctrinary statement was prepared for members of the various ships' companies and the X-Ray Division (see Section 2.005).

Other conferences had to do with preparation of the Operation Plan (see Section 2.003), the preparation of progress reports, general proposals concerning radiological health and safety, a plan for the initial landing operation (see Section 2.012), organization of the X-Ray Division, and the institution of daily Planning Conferences upon arrival at the resurvey site (see Section 2.011).

Staff Conferences were continued while at Bikini, for purposes of reviewing progress, making necessary adjustments in plans and programs and generally assuring that the work of scientific investigation would proceed in an orderly and efficient fashion.

2.005 Organization of the X-Ray Division

One hundred and eighty-three enlisted men, including 17 Chief Petty Officers were assigned to the Bikini Scientific Resurvey by the Chief of Naval Personnel. This complement of men was designated the X-Ray Division, the overall function of which was supplying necessary facilities and services for the resurvey.

Lieutenant Commander R. L. Reaser was assigned as X-Ray Division Officer. Lieutenant Commander Reaser organized his electronic technician's mates, machinist's mates, pharmacist's mates, boatswain's mates, photographer's mates, gunner's mates, electrician's mates, carpenter's mates, steward's mates, draftsmen, ship's cooks, yeomen, storekeepers, radiomen, radarmen, coxswains, stewards, and seamen into the varied working groups necessary to support the diversified scientific investigations being conducted in the vessels of Task Group 10.12 and on the islands and reefs of Bikini Atoll. The X-Ray Division worked in very close cooperation with members of ship's companies.

In addition to normal commissary and administrative functions, services peculiarly necessary in the Bikini Scientific Resurvey proved to be those associated

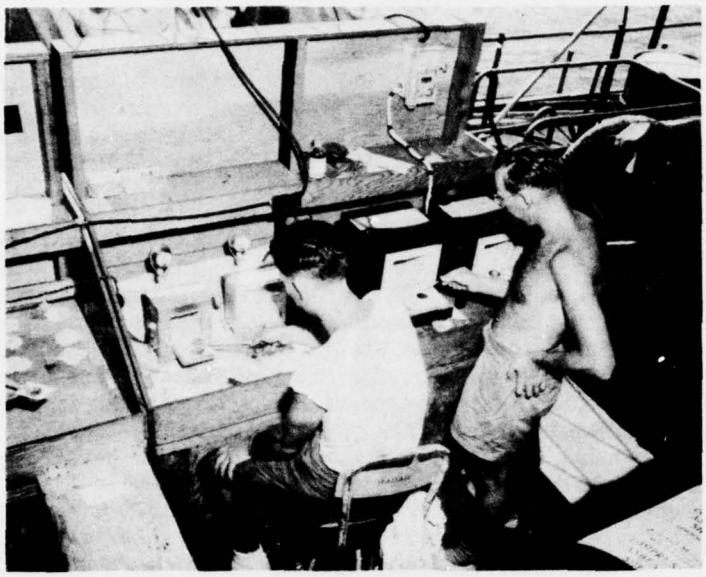

Figure 8. Two scientists ashing samples of tissue in the Radiobiology Laboratory aboard CHILTON (APA-38). ABCR Photo No. 5033-10.

Figure 9. Mr. J. C. MARR (right) and Dr. O. R. SMITH, both of the Fish and Wildlife Service, examining specimens and recording data in the Fisheries Laboratory aboard CHILTON (APA-38). ABCR Photo No. 5044-11.

with construction and rehabilitation, communications, support of diving operations, handling of small craft, medical care, and photography.

2.006 Establishment of Laboratories

Even before Chilton (APA-38) departed San Diego, installation of requisite laboratory facilities had been instituted by the Technical Director, who was assisted in this work by Lieutenant Commander R. L. Reaser, upon the latter's arrival at San Diego. Development of these laboratories was continued while Chilton (APA-38) moved to the resurvey area, so that on 15 July 1947, this phase of preliminary planning and work had been brought to a successful conclusion. Subsequently, other laboratory centers were developed on Bikini Island to support the scientific activities of shore-based personnel.

The facilities of two Radiochemistry Laboratories and of the Counter Room, located aboard Chilton (APA-38), were available to the Technical Director, the Radiochemistry, Radiobiology, and other Groups, for purposes of determining the amount of radioactivity present in samples of sea water, bottom sediment, coral, birds, fishes, algae, fruits, and similar substances collected at Bikini by the different Scientific Groups. Tests made were concerned with beta, gamma, and alpha radiation. In the case of the Counter Room, special air-conditioning equipment was installed to insure the proper functioning of critical electrical gear (see fig. 6).

Closely associated with the foregoing laboratory was one used by the Radiobiology Group under the direction of Dr. L R. Donaldson, which group collected samples of various plant and animal tissues in the Bikini area, and made gross beta counts of many of them. Figure 8 shows two scientists in the Radiobiology Laboratory using muffle-furnaces to ash samples. Other specimens were preserved and packaged for return to the United States, to provide the material basis for continuing studies. The Radiobiological Laboratory also was aboard Chilton (APA-38).

The Fisheries Laboratory under direct supervision of Mr. V. E. Brock, was established in Chilton (APA-38) as a center where reef and lagoon and pelagic fishes collected in the area could be identified; studied with respect to any existing abnormality, food habits, or other characteristics; and in some cases preserved for future research work. Studies of invertebrates collected by Dr. J. P. E. Morrison also were conducted in this laboratory. Figure 9 shows two scientists at work in the Fisheries Laboratory.

An Experimental Biology Laboratory, was first developed aboard Chilton (APA-38), and later moved to the shore establishment on Bikini Island, where it was represented by two laboratories: one devoted to morphological and physiological studies of plants, and the other to developmental studies of marine invertebrates. One of the Experimental Biology Laboratories on Bikini Island is shown in figures 10 and 11.

A Photography Laboratory was installed aboard Chilton (APA-38) to provide for processing of film, contact prints, and enlargements; and also to service and repair the still cameras, underwater cameras, and motion-picture cameras used in the resurvey work. It was necessary to provide special cooling equipment in this laboratory, in order to maintain optimum temperatures of photographic solutions while the Task Group was in tropical waters. Associated with the Photography Laboratory was an activity devoted to photographic dosimetry, and more particularly the processing and examination of film badges.

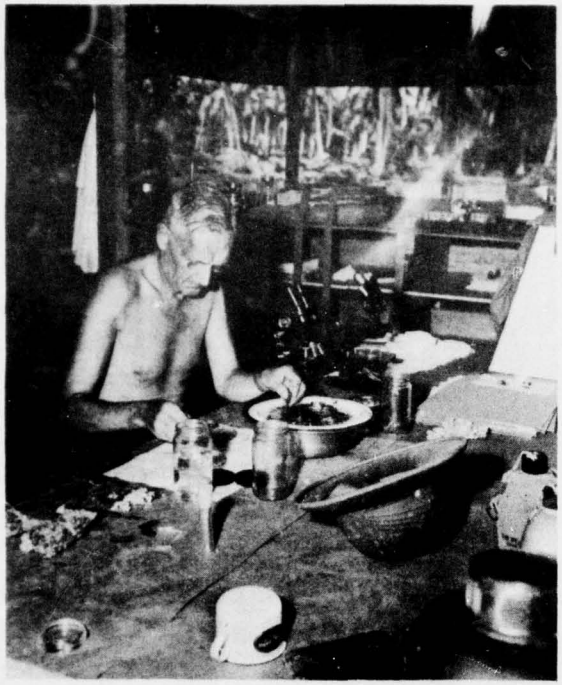

Figure 10. Dr. G.M. SMITH of Stanford University examining marine plants in one of the Experimental Biology Laboratories on Bikini Island. ABCR Photo No. 5034-6.

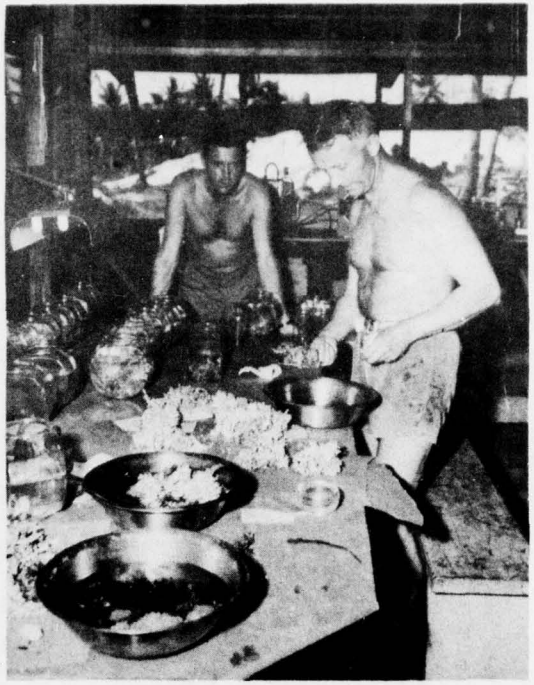

Figure 11. Dr. L.P. BLINKS (foreground), Director of the Hopkins Marine Station, and Dr. P.M. BROOKS of Stanford University, making tests on marine algae in one of the Experimental Biology Laboratories established on Bikini Island. ABCR Photo No. 5034-5.

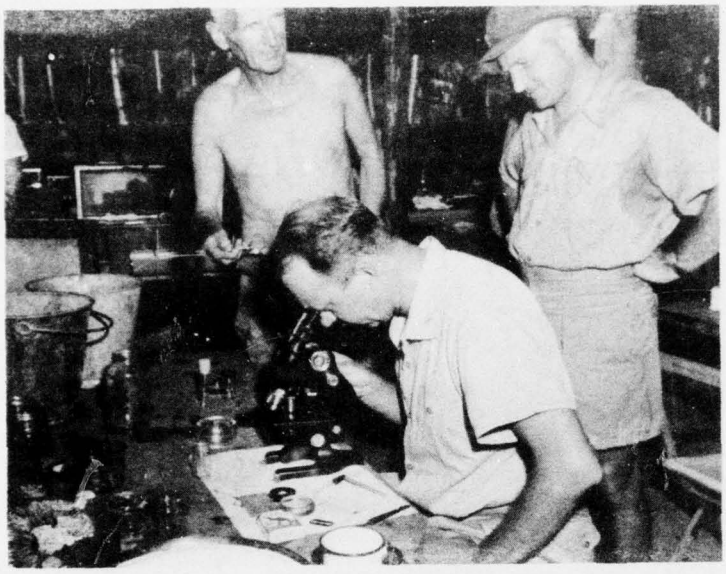

Figure 12. CAPT C.L. ENGLEMAN examines a marine alga, while Dr. G.M. SMITH and CDR R.S. BROOKINGS look on. ABCR Photo No. 5041-6.

Figure 13. Dr. H.S. LADD of the U. S. Geological Survey, and Mr. V.C. MICKLE, Supervisor, G.E. Failing Co., examining core samples in the Geology Laboratory on Bikini Island. ABCR Photo No. 5029-9.

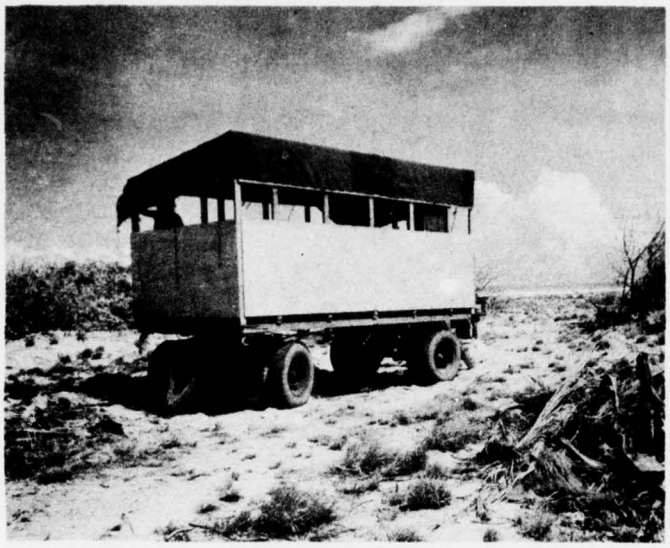

Figure 14. Mobile laboratory established on Bikini Island for making studies concerned with the chemistry of sea water. ABCR Photo No. 5029-10.

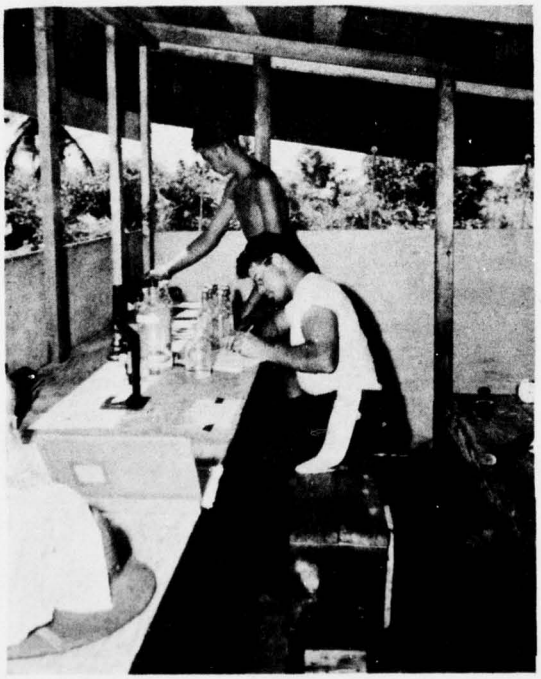

Figure 15. Recording data obtained from the study of water samples in the mobile laboratory on Bikini Island. ABCR Photo No. 5029-11.

In addition to the Experimental Biology Laboratories, mentioned above, three other laboratories or scientific group centers were established on Bikini Island. One of these, under the immediate supervision of Dr. J. H. Roberson and Mr. F. M. Simons was devoted to the study of low-level radiation. Another beach establishment served as a center for the Geology and Aerology Groups, (see fig. 13), and a third was represented by a mobile unit in which studies were conducted on the relationship of marine organisms to the chemical content of sea water (see fig. 14).

In order to assure the safety of scientific apparatus and supply located within the laboratories, to facilitate carrying out the plan of the day, and to provide for the presence of a Staff Officer at all times, and especially at night, a Staff Duty Watch was established on 4 July 1947, under direction of the Administrative Officer. This Duty Watch assured round-the-clock security and safety of all laboratory spaces aboard Chilton (APA-38), and cooperated with the Officer of the Deck in matters related to the assembling of work parties and the dispatch of boats.

2.007 Scientific Group Activities Enroute Bikini

From the time Chilton (APA-38) left San Diego until arrival at Bikini, members of the various Scientific Groups were at work informally, perfecting detailed plans for operations under the direction of the Project Officer and the Technical Director. Many of the scientists also were participating in the work of organizing laboratories aboard Chilton (APA-38), as described in Section 2.006.

On 2 July 1947 the Project Officer appointed an Advisory Board, consisting of Scientific Staff members, and constituted as follows:

Dr. D. M. Whitaker, Chairman
Dr. L. R. Donaldson
Dr. J. H. Roberson
Dr. R. D. Russell (Mr. E. H. Shuler to act prior to arrival at Bikini)
Dr. L. P. Schultz
Dr. H. S. Ladd (Mr. J. I. Tracey to act prior to arrival at Bikini)

Insofar as practicable, this Advisory Board included representation of the major scientific activities involved in the resurvey. The function of the Advisory Board was to council with the Project Officer on administrative problems, and especially those problems having to do with allocation of laboratory space and facilities, and conduct of the scientific work program.

At a meeting of the Advisory Board with the Project Officer held on the same date, it was agreed that a seminar series under the Co-Chairmanship of Dr. Whitaker and Dr. Donaldson would be initiated while Chilton (APA-38) was enroute Bikini Atoll (actually, the final seminar was held subsequently to arrival at Bikini), for the purpose of informing scientific personnel about the background, purposes, and methods of the studies proposed in the Bikini Scientific Resurvey.

A brief summary of the indoctrination lectures given in this series is as follows:

1. Captain C. L. Engleman, U.S.N., "Operation Crossroads".
   Captain Engleman briefly outlined the background of the Bikini Scientific Resurvey, and defined its objectives. He then presented the Operation Crossroads motion pictures, in both black-and-white and color versions, with comments on the phenomena represented in the various sequences.

Figure 16. A reef pool on the seaward reef of Bikini Island. In this area the coral growths spread out laterally at the surface, leaving coral pillars separated by surge channels underwater. The wearing of face masks facilitates underwater examination of this phenomenon. ABCR Photo No. 5019-9.

2. Dr. J. W. Wells, "Geological Features of the Pacific".

Dr. Wells pointed out that an almost continuous volcanic chain marked by seismic activity borders the Pacific Ocean; and that deeps of the Pacific are almost all close to continental masses. The volcanic line and the area of the deeps is marked by negative gravitational potential, which fact may suggest continental drift toward the central Pacific area. Rocks of bordering continents are predominantly granitic, with a density ‡2.7, whereas in the Pacific Ocean area the rocks are basaltic and have a density ‡3; suggesting a sagging of the heavier ocean basin. Islands in the Australasian area are basically granitic, and may represent continental areas that have been fragmented; whereas islands of the Mid-Pacific are basaltic, and many are volcanic. Various theories as to the origin of atolls were discussed, including the hypotheses of Darwin, Dana, Davis, and Daly. Dr. Wells indicated that the prevailing modern hypothesis postulated the formation of flat island platforms at depths of 150 to 200 ft.(seven or more theories as to the origin of these platforms), and the building up of coral reefs upon such bases.

3. Mr. J. I. Tracey, "Geology of Bikini".

Mr. Tracey stated that normal sea bottom in the Bikini area is at 2,500 fathoms, from which cone-shaped structures bearing the atolls rise to the surface. The slopes of these cones range from a few degrees to 45° or more, and average about 22°. Bikini Atoll is crowned by a reef encircling the lagoon. The reefs are about one-half mile wide, and on them are some 26 major islands, principally made up of the remains of corals, algae, and foraminifera. Bikini Lagoon exhibits depths of more than 30 fathoms, as does one of the narrow passages on the southwest side; Enyu Channel really is a submerged reef. Currents inside the lagoon are largely due to wind effects, and to water piling over the reefs; tidal velocities in the southwestern passes are 1.0 to 2.5 kt. The reefs show definite zoning parallel to the reef front, and the three most significant zones may be described as follows:

(a) Marginal Zone of Lithothamnion ridge

A narrow zone of red, calcareous algae forming the reef margin, and cut by numerous water channels on the windward side. The algal rim stands up as a ridge on the windward side, two to three and a half feet above the reef flat. Algae are represented by only about a dozen species, but they are the most important surface reef builders, and serve to cement the corals together. Buttresses occur along the lithothamnion ridge on the windward side.

(b) A coral-algal zone that is not always present

About 150 coralline species are found in the Bikini area, and about 30 species are common reef builders.

(c) The main reef flat

This is barren and flat, and is composed of an eroded algal limestone, often covered with a thin veneer of brown algae.

4. Dr. J. P. E. Morrison, "Invertebrates and Higher Vertebrates of Bikini".

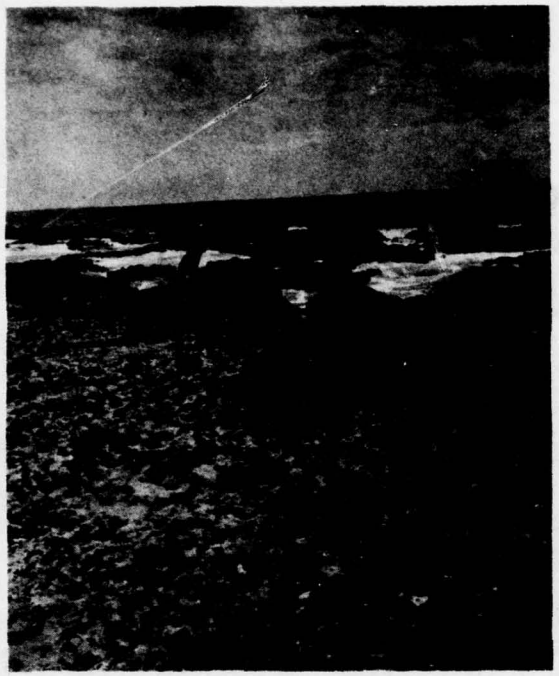

Figure 17. The outer area of a reef flat with the lithothammion ridge broken by surge channels beyond. ABCR Photo No. 5021-9.

Figure 18. A giant clam taken from the bottom of Bikini Lagoon. ABCR Photo No. 5046-11.

Dr. Morrison described life zones of the area as follows:

(a) Lithothamnion ridge

Red algae, sea urchins, and some mollusks.

(b) Coral-algal zone

Boring types of sea urchins, brittle stars, and sea cucumbers are found here.

(c) Reef Flats

Characterized by the presence of snails such as cowries, other mollusks, annelid worms, sea urchins, sea cucumbers, and a small type of giant clam (two larger species are found out in moderately deep water). A primitive chordate type, a balanoglossid or "acorn worm" also is found here. Animals of the outer reef area are about the same as those on the inner flats.

(d) Transitional zone

An area along the shore where transitional types of snails are found. In all, some 500 species of bivalves and gastropods are represented in the Bikini area.

(e) Land Area

Various species of hermit crabs live out upon the land; a coconut crab is similar to the hermit crabs but too large to go in a shell. A true species of land crab is found on one island. Various insects, spiders, and one species of scorpion are represented. Three species of lizards have been identified, including a gecko. About 20 different species of birds have been seen, including frigate birds, the red-footed booby, six species of terns, a New Zealand cuckoo that migrates to Bikini, the ruddy turnstone, the golden plover, various other shore birds, and a reef heron. The only native mammal other than porpoises is a small species of rat. A more or less representative land area is shown in figure 20.

5. Dr. L. P. Schultz, "Fishes of the Pacific".

Dr. Schultz indicated that members of the family cyprinidae occur almost continuously in freshwater streams on both sides of the Pacific Ocean (suggesting former land connections) but are absent on islands of the Pacific. The center of abundance for marine fishes is in Oceania and the Indo-Australian area (perhaps 10,000 species), and the number of species represented becomes progressively smaller as one goes eastward. Two general types of fishes are found at Bikini: the reef fishes and the pelagic fishes. Poisoning of measured areas of reef water was carried out in 1946 to determine fish concentration prior to Operation Crossroads; it was found that there were in various habitats from .02 to 1.2 fish per square yard of surface, but probably not more than half of the fish in test areas were recovered. The basic food of fishes at Bikini is plankton and attached algae. At least 300 species of fish are

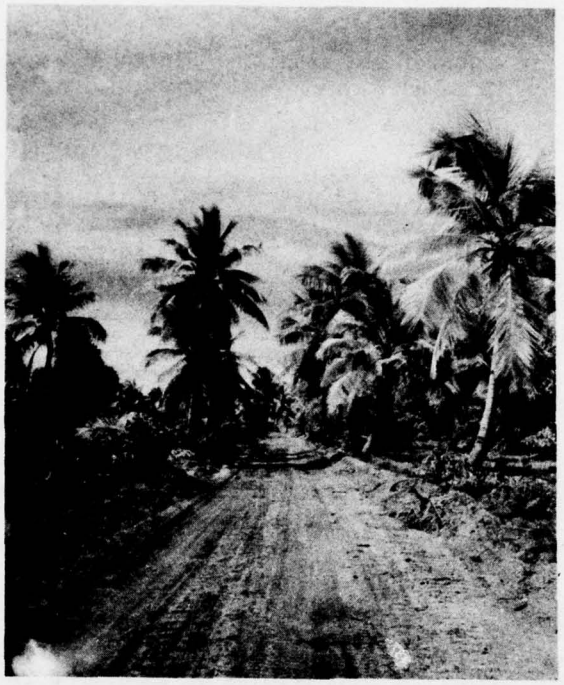

Figure 19. Old main road on Bikini Island restored to use during the resurvey. The vegetation shown here is more or less characteristic of islands making up Bikini Atoll, although denser growths are found in some localities, especially on Enyu Island. Personnel who had seen the islands prior to OPERATION CROSSROADS commented that the vegetation thereon appeared to be perfectly normal. ABCR Photo No. 5027-4.

found at Bikini, and among them are such types as pipe fishes, needle fishes, trumpet fishes, surgeon fishes, damsel fishes, groupers, sea basses, goat fishes, cardinal fishes, blennies, trigger fishes, butterfly fishes, barracudas, albacores, tunas, sole, and eels. Fish are more abundant on the leeward side of the lagoon. The elasmobranchii are represented by several species of sharks and rays.

6. Mr. V. E. Brock, "Hazards of Reef Collecting".

Mr. Brock stated that one species of sea urchin at Bikini has slender, poisonous spines, that some of the mollusk shells are also spined; that there are some stinging corals, and that certain stinging jellyfishes and the Portuguese man-of-war may be encountered. Spiny lobsters should be handled with gloves. Some of the fish at Bikini have spines at the base of the tail, or incorporated in the dorsal fin, and one species has a poison gland associated with its dorsal spines. Moray eels, which attain a length of six feet, are capable of biting viciously. Three relatively small species of shark found at Bikini include the black-tipped shark, the white-tipped shark and the gray shark. These three sharks are quite capable of biting, but are not particularly aggressive; however, other species of sharks are likely to be met with in the area. Food poisoning associated with fish is of three primary types, as follows:

(a) Due to decay

(b) Some species, including weakfish, sea basses, amberjack, and barracuda ordinarily are edible, but prove to be poisonous in some localities, presumably because of certain foods that they have eaten.

(c) Some species, such as puffers, are characteristically poisonous.

7. Dr. A. D. Welander, "Effects of Radiation upon Organisms".

Dr. Welander suggested that high metabolic rate and large size apparently are correlated positively with sensitivity to radiation. Thus, algae, bacteria, viruses, and protozoa are quite resistant to radiation effects, except when in rapidly growing stages. The latent period in the case of lethal dosage varies, but tends to be shorter in the case of homiothermal organisms; young animals seem to have a longer latent period than corresponding adults. High mitotic rate in any tissue is correlated positively with susceptibility to radiation effects; sex cells, blood-forming tissues, and glandular epithelium are particularly sensitive; connective tissues and nerve tissues are less sensitive. Radiation is followed immediately by slowing down of mitotic rate and acceleration of cell death-rate, although some tissues exhibit recovery after the passage of time. However, sex cells and the ectodermal derivatives tend to be permanently affected. There is some evidence that sudden death occurs in the third generation of irradiated cells, and any degree of irradiation seems to be destructive.

8. Dr. F. H. Rodenbaugh (M.D.) Sr., "Effects of Radiation on Man".

Dr. Rodenbaugh stated that studies of human radiobiology have all been confined to the past 50 years. Early investigations were on X-Ray effects, radium having become a problem about 1900, and the ingestion of alpha-emitters coming on the scene circa 1920. Radium poisoning, unlike

lead poisoning, cannot be cured. The effect upon human tissues is primarily a matter of the extent to which cell ionization is developed. Even sunlight produces some ionization. In order of sensitivity, tissues rank as follows: sex cells (most sensitive); blood-forming tissues; hair. Beta and gamma radiation probably will be of low intensity at Bikini, but various potential food materials in the area may contain alpha-emitters.

9. Commander H. S. Etter (MC), "Operation Plan for Radiological Safety at Bikini".

Dr. Etter indicated that pre-tests for skin lesions, circulatory abnormalities, and respiratory disease had been given to insure that no peculiarly susceptible personnel would come in contact with alpha-emitters; and that film badges would be worn by all personnel going ashore in suspect areas, to furnish an index of the amount of beta and gamma radiation received. It was specified that gas masks with B-type canisters would be worn in the event of a radiological dust hazard. Personnel were warned to report cuts or similar injuries promptly, and to avoid eating any plants or animals found in the Bikini Area.

10. Lieutenant Colonel C. E. Grant (Cml.C.), "Operation Plan for Radiological Safety at Bikini, Contd."

Lieutenant Colonel Grant stated that Radiological Safety Officers would make a complete survey of the atoll, and that for the moment, conditional clearance would be given for field work as fast as monitoring operations were completed. Lieutenant Colonel Grant specified that all work parties would return to Chilton (APA-38) via the port gangway, and would be monitored as they came aboard; in the event that readings were more than twice normal background an individual would be sent to decontamination station. It was ordered that green issue clothing be used by personnel working on the reefs and islands, and that all specimens and samples be properly packaged before they were brought aboard ship. The warning against eating native fruits and similar materials was reiterated.

11. Commander Roger Revelle, "Phenomena of the Baker Day Explosion".

Commander Revelle stated that Bikini Lagoon (see fig. 22) has an area of 200 mi^2 and a volume of 5 mi^3, with only 4% of the water lying below the deepest channel outlet. In fall, winter and spring the prevailing wind is NE, averaging 20 kt. and waves produce about a one-foot water head along the northeastern reefs, which causes water to spill over into the lagoon. In the lagoon, a surface layer of water about 40 ft. thick moves from NE to SW, and a lower layer of water about 120 ft. thick moves from SW to NE at a slower rate. Along the eastern side of the lagoon, water from the lower level rises, and moves westward in the surface current. About 7½% of the lagoon water flows out daily on ebb tide through the southwest passes, but most of this water comes in on the flood tide. Flood-tide current is 1½ kt, while ebb-tide current is 2½ kt. The excess of water flowing outward on the ebb, as compared with inflow through the southwestern passes, is due to the constant inflow over the northern and eastern reefs. During the winter season, about half of the water in the lagoon is replaced every 22 days. Some water enters the lagoon on the east side of Enyu Channel, and exits on the west side of the same channel, without mixing to any extent with the main body of lagoon water.

During the summer, trade winds are largely absent. As long as any existing wind has an east component surface water in the lagoon flows west, and the deeper layer moves eastward. The principal source of new water is Enyu Channel. Two or three times in the summer saltier and therefore heavier water of the ocean moves in and flushes out the lagoon rather quickly. In summer, a noticeable vertical stratification of lagoon water as to oxygen content, salinity, and temperature develops. The shape of Bikini Atoll is associated with currents, and with the distribution of plant fertilizers in the water.

The Baker explosion took place about three miles off the center of Bikini Island, and about half way between the surface and the bottom. A column of water about 2,000 ft in diameter was thrown up to a height of 8,000 ft. The column was actually more or less hollow, and represented a suspension of water in air, but it contained about 500,000 tons of water. The falling column formed a "base surge", which originally was about 1,000 ft. high, and moved outward at an initial speed of 50 to 60 kt. This base surge increased in volume but lost density due to absorption of air and falling of water drops; it eventually extended outward to a diameter of 6,000 yd. About an inch of highly contaminated rain fell in the target area.

Several hours after the Baker explosion there was considerable radioactivity in the top 100 ft. of water. Although, due to very light S wind the surface current immediately after the explosion flowed north over the the reef, normal surface circulation of lagoon water moved off to the west. Between Baker plus four and Baker plus eight a large proportion of the radioactive material apparently was flushed out of the lagoon. Radioactive sediment settled to the bottom in the target area, and as late as 9 August 1946, plants along the northern reefs were quite radioactive (concentration of radio-activity in the water was non-detectable at this time with the facilities available).

2.008 Public Information

Public Information Officer for the Bikini Scientific Resurvey was Lieutenant Commander W. R. Richardson, who reported to the Bureau of Ships, Code 181, for duty on the Staff of the Project Officer on 12 June 1947.

Lieutenant Robert Givens U.S.N., on temporary duty orders from the Office of Naval Research, assisted with the early public information duties. At Pearl Harbor two enlisted Navy correspondents, S. L. Lubin, S1, and Murray Floyd, S1, were assigned on a temporary duty basis to the Public Information Section by the Public Information Officer, Commander-in-Chief, Pacific Fleet. At Bikini, on 17 July 1947, D. C. Camp, civilian employee of the Naval Electronics Laboratory, San Diego, reported to the Project Officer for duty with the Public Information and Reports Sections.

Annex L of the Operation Plan (Appendix D, pg. 111) outlined the pattern for Public Information followed during the course of the Bikini Scientific Resurvey. Press Summary Number One was prepared in the Navy Department, Washington, D. C., and was released on 27 June 1947 through the Office of Public Information in Washington. This release described in general the mission of the operation; listed the participating ships; named the Task Group Commander, Project Officer, Technical Director, and certain other officers and civilian scientists.

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On 27 June 1947 the Project Officer, and the Commanding Officer of Chilton (APA-38) held a press conference aboard ship at San Diego. This conference, arranged by the Public Information Officer for the Eleventh Naval District, was attended by representatives of the press in San Diego. At Pearl Harbor on 7 July 1947 a press conference was held aboard the Chilton (APA-38) with the Task Group Commander Project Officer, Technical Director and certain other Staff Officers and participating scientists in attendance. This press conference was arranged by Public Information Officer, CinCPacFlt.

Press Summary Number Two was filed by dispatch prior to Chilton departure from San Diego on 1 July 1947. Regular press summaries of activities were filed enroute Bikini, and thereafter by priority dispatch approximately five times each week. These dispatches reported all significant developments of the Bikini Scientific Resurvey, and included information about the work being done by scientists and military personnel.

Thirty-five mm. motion-picture film was used to record significant and newsworthy developments at Bikini. Black-and-white still photographs were taken of all newsworthy activities for public information purposes. Captions for the pictures were prepared by the Public Information Officer, and were submitted with the films to the Crossroads Photographic Library, Naval Photographic Center, NAS, Anacostia, Washington, D. C., by air, for security screening and possible release.

The two enlisted Navy correspondents prepared individual stories on military personnel participating in the Bikini Scientific Resurvey, including men on board Chilton (APA-38), Coucal (ASR-8), LSM-382, and LCI(L)-615. All individual stories were mailed to the Navy Home Town News Center, Great Lakes, Ill., in accordance with the established policy of Navy Public Information.

The Public Information Section of the Bikini Scientific Resurvey published twice a week a five-or six-page mimeographed paper. This publication reported the day-by-day happenings of the operation, and was issued to all hands in the Task Group.

An Armed Forces Radio Station (WBSR) was operated on board Chilton (APA-38) during the resurvey. This station was under the general direction of Mr. D. C. Camp insofar as its program arrangements and operation were concerned. The Public Information Section relied upon volunteer help from Task Group personnel to provide announcers, program directors, and newscasters. Mr. Camp also assisted in the preparation of press summaries and special articles, and compiled material for a report in the Undersea Warfare bulletin.

2.009 The Technical Report

The Technical Report was prepared by Lieutenant Commander F. L. Fitzpatrick, Technical Reports Officer, with the assistance of Lieutenant Robert Givens, U.S.N., Dr. J. H. Roberson, and Mr. D. C. Camp. Work on the report began 1 July 1947, and continued until Chilton (APA-38) returned to San Diego.

Volume I of the Technical Report was written by the Technical Reports Staff, largely while enroute Bikini Island. Volume II was prepared in the Bikini area for the most part, the accepted procedure being (a) to conduct first-hand observations in the field, and confer with appropriate administrative officers or members of the Scientific Staff; then to write up the copy, and to submit the copy to competent authority for a check upon scientific accuracy; or (b) to obtain a section of material from the investigator responsible, edit the material,

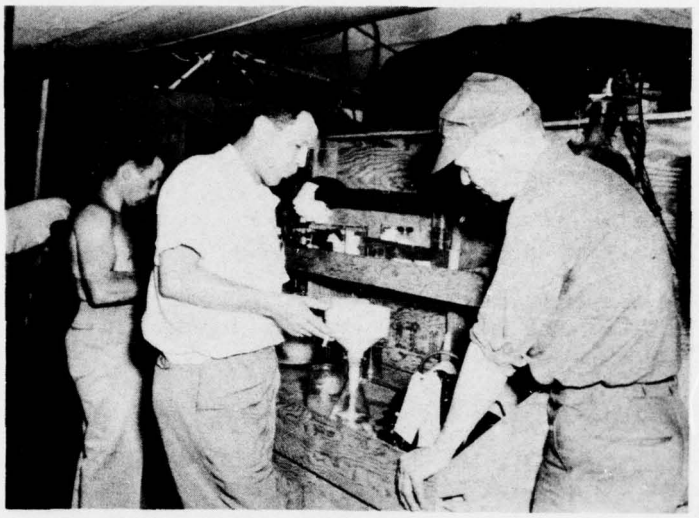

Figure 20. Radiochemistry laboratory aboard CHILTON (APA-38). Dr. P.M. BROOKS of Stanford University is running an analysis of sea water to determine its radium content, while the Technical Director looks on. ABCR Photo No. 5005-12.

Figure 21. A TNT bomb about to be dropped over the side in a SOFAR test. Hydrophone amplifier in foreground. Seamen are holding lines from the hydrophone, which trail astern of CHILTON (APA-38). ABCR Photo No. 5004-2.

and incorporate it in the report. The findings of the Scientific Groups, as represented in this report, necessarily are not final in all respects. This is because of the fact that many specimens and samples had to be returned to the United States for continuing examination and study. In a sense, then, the conclusions here reported represent the more obvious conclusions of the investigators. It was understood that certain individuals on the Scientific Staff, and/or Scientific Groups, would upon compilation and evaluation of all data, report in greater detail, and that such reports would be made available to the Chief of the Armed Forces Special Weapons Project.

Volume III of the Technical Report was prepared in original form by the Director of Ship Material, and was edited and incorporated in the overall report by the Reports Officer and his assistants.

2.010 Tests Conducted Enroute Bikini

One group of tests made while Chilton (APA-38) was enroute Pearl Harbor to Bikini Atoll was concerned with samples of sea water, which were analyzed for radioactive content to establish a background figure with which lagoon water from Bikini Atoll could be compared. Laboratory testing of a water sample is shown in figure 23.

A series of Sofar tests also were undertaken enroute San Diego to Bikini. The first of these tests was made on 5 July 1947, when a bomb carrying a 4 lb. charge of TNT was dropped over the stern of Chilton (APA-38), enroute Pearl Harbor, and detonated. United States Coast Guard D/F station at Castroville, California, equipped with Sofar receiving gear, stood by at the pre-arranged time to record the shot. The shot, however, was not heard, although it was believed that the TNT had detonated. Three additional tests were made while Chilton (APA-38) was enroute Pearl Harbor to Bikini Atoll on 9, 10, and 11 July 1947, with similar results. In all cases charges consisted of 4 lb. of TNT (one contained 16 lb. of TNT) and were equipped with 150 fm, 350 fm, and 700 fm detonators. Observers aboard Chilton (APA-38) were strongly of the opinion that only the detonators were fired in these latter tests, and that main charges failed to explode. Scenes depicting the Sofar tests are shown in figures 24 and 25.

A summary of the foregoing findings and opinions was forwarded by Dr. R. D. Russell to Director, U. S. Navy Electronics Laboratory, San Diego, on 16 July 1947, with a proposal that further tests be made using Wood's Hole interim-type bombs, while Task Group 10.12 was in the vicinity of Bikini Atoll, and enroute Pearl Harbor; and it was requested that bombs of this type be forwarded to Chilton (APA-38). On 20 July 1947, U. S. Navy Electronics Laboratory reported by dispatch that further Sofar tests were deemed to be inadvisable.

Many additional routine tests of scientific instruments were made prior to arrival at Bikini. Among them was a test carried out on 13 July 1947, in which a container of radium carried aboard Chilton (APA-38) for instrument-calibration purposes was secreted, and monitors equipped with Geiger counters set about to determine its location. The monitors located not only the radium container, but also X-Ray equipment in the dental office, and some luminous buttons in the tailor shop. The purpose of this test was to assure that Geiger counters were in good operating order at the time of the initial landing.

2.011 Daily Planning Conferences

Prior to arrival at Bikini, it was recognized that daily investigations would be carried out in a number of widely scattered localities, including the

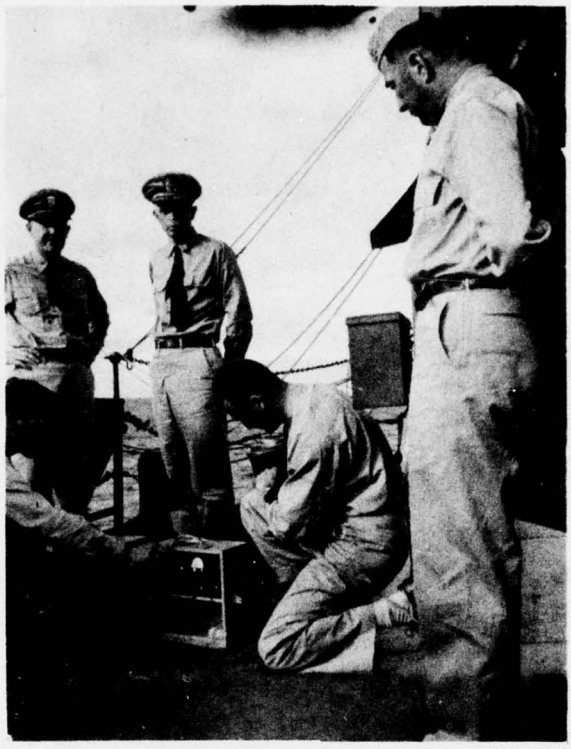

Figure 22. Ready for a SOFAR test. Mr. E.A. SHULER and Ensign B.W. TIMMER kneeling by hydrophone amplifier, standing, left to right, Captain T.H. HEDERMAN, Commander E.S. GILFILLAN, and Captain R.W. LAJEUNESSE. ABCR Photo No. 5004-4.

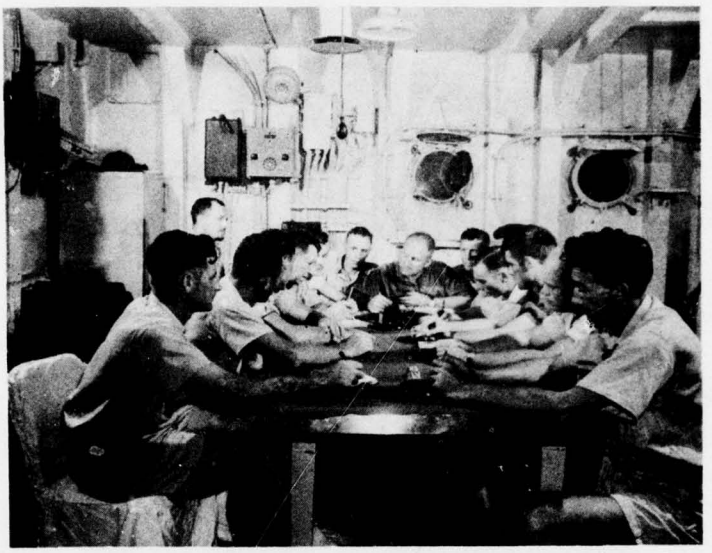

Figure 23. A planning conference being conducted aboard CHILTON (APA-38) by Commander R.S. BROOKINGS. ABCR Photo No. 5056-5.

various islands of Bikini Atoll and associated reefs and that logistic requirements would be numerous and diversified. Accordingly, on 11 July 1947, the Project Officer formed a planning organization, which held daily meetings (except Saturday) by way of providing the most efficient boat service, supply service, and other services required by Scientific Groups working in the field or in the laboratories.

The Administrative Officer served as Chief Planner. The Officers-in-Charge of organizations providing services (X-Ray Division, Ships' Boat Group Commander, and CBD 1800) met with the Chief Planner, and with other Staff Officers who represented the various Scientific Groups. Requests for services were presented at these meetings, and if the urgency and practicability thereof were concurred in by the planning conference, and requested facilities were available, officers in charge of services were directed by the Chief Planner to fulfill the requests.

Thereupon, a plan for the following day was prepared, and copies were distributed to all individuals and groups affected, including the Officer of the Deck aboard Chilton (APA-38), and the Staff Duty Officer. This Staff Plan of the Day tended to assure that required facilities would be available at the right time and in the right place.

2.012 The Re-Entry Plan

As previously noted, a Re-Entry Plan was formulated as Annex K of the Operation Plan (see Appendix D, pg. 108). This plan provided for an advance reconnaissance party landing upon Bikini Island and other areas to be occupied during initial phases of the resurvey, and outlined procedure for off-loading Chilton (APA-38).

In addition, the Project Officer prepared and circulated to the Staff a memorandum detailing procedures to be followed in the advance landing operation. This memorandum listed the boats and personnel to leave Chilton (APA-38) on 15 July 1947 for Bikini Island and Prayer Island, and specified radiological safety precautions to be taken. Procedures outlined in this memorandum became the basis for the operation described in the following Section.

2.013 Initial Landing Operations

Coucal (ASR-8) was in sight of Chilton (APA-38) at 0700 on 15 July 1947, the target date. The two vessels proceeded in company and passed through Enyu Channel (see fig. 1) at 1030; Coucal anchoring in the vicinity of sunken Saratoga, and Chilton off Bikini Island.

At 1145, just 355 days after Test B, Captain C. L. Engleman, U.S.N. led a party of military technicians ashore on Bikini Island (see fig. 24) to inspect existing installations and monitor the beach. In addition to the Project Officer, this initial landing party included Commander E. S. Gilfillan, Lieutenant Colonel C. E. Grant, Commander J. R. Denny, Commander H. S. Etter, Lieutenant Commander F. L. Fitzpatrick, Lieutenant Commander R. L. Reaser, Lieutenant Commander W. R. Richardson, and Lieutenant (j.g.) J. L. Greiner. Radiological Safety and Radiological Health Officers obtained beta and gamma readings along the beach, and in many inland localities (see fig. 24). Readings inland from the beach were uniformly about the same as normal background. In this beach area (lagoon side) radioactivity appeared to be concentrated in old life rafts, fenders, and similar materials, which may have been washed ashore from sunken target

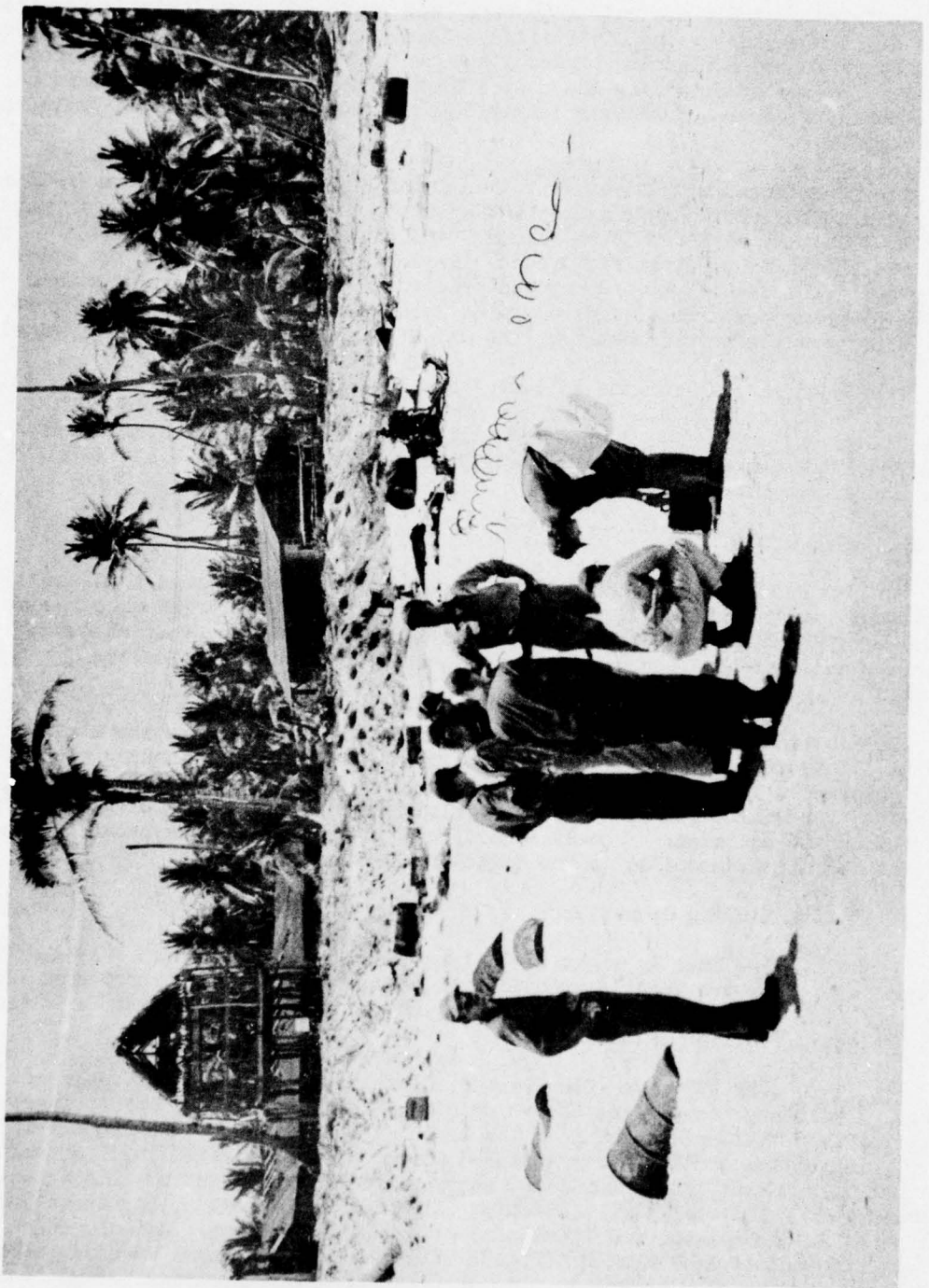

Figure 24. Monitoring the beach of Bikini Island on the day of the initial landing. ABCR Photo No. 5008-9.

Figure 25. Beach on lagoon side of Bikini Island, looking north. Note wreckage and materials washed up subsequent to OPERATION CROSSROADS. Some of these materials yielded counts significantly above background. ABCR Photo No. 5011-2.

Figure 26. Beach on the lagoon side of Bikini Island looking south, as it appeared in 1947. Note miscellaneous gear washed up on the beach following OPERATION CROSSROADS. ABCR Photo No. 5030-9.

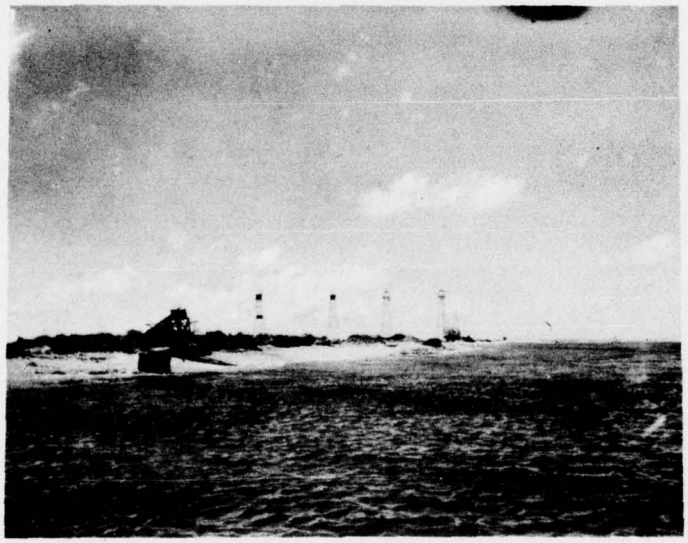

Figure 27. The beach of Amen Island as it appeared in 1947. The four towers housed automatic cameras and electronic equipment at the time of OPERATION CROSSROADS. ABCR Photo No. 5022-8.

ships. Figure 25 is a typical scene showing such materials on the beach. Representative samples were obtained from all areas and returned to Chilton (APA-38) for purposes of making alpha counts.

All members of the initial landing group were required to wear long-sleeved shirts, full-length trousers, and heavy work shoes. They were monitored upon return to Chilton (APA-38) to prevent ship contamination, and to assure necessary decontamination of personnel, a change station having been provided for the latter purpose. In addition, all personnel wore film badges designed to record both beta and gamma radiation, and monitors carried pocket dosimeters. Readings of the pocket dosimeters and examination of developed film badges indicated that no individuals had been exposed to dangerous beta or gamma radiation. The full report of the Radiological Safety officer is included as Appendix E.

The landing party gave special attention to possible indications that Bikini Island had been occupied or visited since the withdrawal of military personnel following Operation Crossroads. No positive evidences of such occupancy were detected. Vegetation on the island appeared to be normal for the region and the season. Installations remaining on the island were found to be in reasonably good condition, considering the fact that they had been unoccupied for so long a time. Three small boat piers proved to be usable. The Construction Officer promptly set about inspecting facilities available for CBD 1800, and offloading of Chilton (APA-38) was begun.

Immediately after the initial landing, Commander E. S. Gilfillan led another group of military technicians to Prayer Island (fig. 28) where monitoring operations were carried out also. It was desired to assure radiological safety on this island as soon as possible, in order that scientists could take advantage of unusually low tides and collect on the reefs.

Contact with Kwajalein was established by the arrival of two Navy Catalina planes, bringing personnel scheduled to participate in the Bikini Scientific Resurvey, including Commander Roger Revelle, the Rear Echelon Officer, who participated actively in resurvey activities until 29 July 1947. Commodore G. A. Seitz, Atoll Commander, Kwajalein, arrived to confer with Commander, Task Group 10.12 on 16 July 1947. Scientific groups were at work on Bikini Island and Prayer Island on 16 July 1947.

2.014 Off-Loading and Construction at Bikini

As soon as radiological reports from the initial landing operation (Section 2.013) were analyzed, and the radiological safety of various areas on Bikini Island was assured on 15 July 1947, off-loading of beach gear from Chilton (APA-38) was begun in accordance with Annex K (Re-Entry Plan) of the Operation Plan (see Appendix D, pg. 108). Some equipment also was transferred to Coucal (ASR-8) and LCI(L)-615, according to plan.

The Construction Officer had meanwhile located an acceptable beach for offloading purposes on Bikini Island, had surveyed the conditions of existing structures on the island; and had determined that rehabilitation of these existing structures, supplemented by the use of several tents, would provide adequately for required housing facilities on the beach. Existing recreation facilities on the island were found to be in usable condition.

An old road patrol (grader), two bulldozers, a crane, a power shovel, two wagons, and a refrigerator, abandoned following Operation Crossroads, were restored to operating condition and employed in the work of rehabilitation.

Figure 28. Initial Landing Party monitoring the beach on Prayer Island. Commander E.S. Gilfillan observes the Gieger Counter as Lieutenant Commander R.L. Reaser checks the readings.

Figure 29. SeaBee shop area on Bikini Island. ABCR Photo No. 5011-1.

Figure 30. Old Officers' Club on Bikini Island rehabilitated as a SeaBee bunkhouse. ABCR Photo No. 5011-6.

Sufficient old lumber, piping, bolts, nails, and similar items were salvaged to meet existing needs, as was a certain amount of fuel oil and gasoline. The main road along the beach was quickly restored, and the following existing structures were converted to the uses indicated:

Old SeaBee beer hall	converted into modern galley
Old officers club	converted into barracks
Old enlisted beer hall	restored for same function
Several small frame structures	converted into laboratories for experimental biology (2), low-level radiation studies, oceanographic chemistry, and geology.
Old SeaBee officers club	restored as officer's club

Water transported in tanks from Pearl Harbor was transferred to water tanks on the beach. Light and power were provided by portable generators brought along for that purpose.

During the period from 15 July 1947 to 22 July 1947, off-loading and construction work on the beach proceeded from dawn to dark, with the result that the schedule set up in Annex K of the Operation Plan (Appendix D, pg. 108) was met; and on 22 July 1947, 38 SeaBees and 16 civilians were moved to the shore establishment.

Construction activities were also involved in the drilling operations (see Section 2.018). It was necessary to erect a suitable platform at each drilling location, and to supply required power, water, and general logistic support.

2.015 Operations at Bikini

While at Bikini Atoll, Task Group 10.12 operated on a six day per week schedule. As previously noted, reoccupation of Bikini Island was begun on 15 July 1947, and Scientific Groups were at work on the reefs and islands the following day. LCI(L)-615 arrived on 17 July 1947, and anchored in Bikini Lagoon, having been held at Kwajalein to load needed gear and supplies.

Divers from Coucal (ASR-8) made preliminary dives on Saratoga on 17 July 1947, finding the latter vessel in a nearly upright position on the bottom although the lower part of her hull was buried in the mud. Figures 33 and 34 show two scenes taken while diving operations on Saratoga were in progress. The first drilling operations were begun on 18 July 1947, just inside the reef on the seaward side of Bikini Island, and thereafter the drillers worked in night and day shifts. The first drill hole was at 300 ft. on 20 July 1947, at which time the drill rig was moved to a second locality just off the beach on the lagoon side of Bikini Island. Figure 38 shows the drill rig in position to begin operation at the site of drill hole No. 1. Studies of submarine geology were begun meanwhile, scientists working from the decks of LCI(L)-615 in Bikini Lagoon.

The rear Echelon Officer, Commander Roger Revelle, joined the resurvey group on 15 July 1947. While at Bikini, he took an active part in the direction of scientific work, and acted as Project Officer for two days, Captain C. L. Engleman being in Kwajalein investigating the possibility of obtaining the use of LSM-382 at the time. Commander Revelle also participated in the seminar discussions, as indicated in Section 2.007. He returned to the United States via Kwajalein and Pearl Harbor on 29 July 1947.

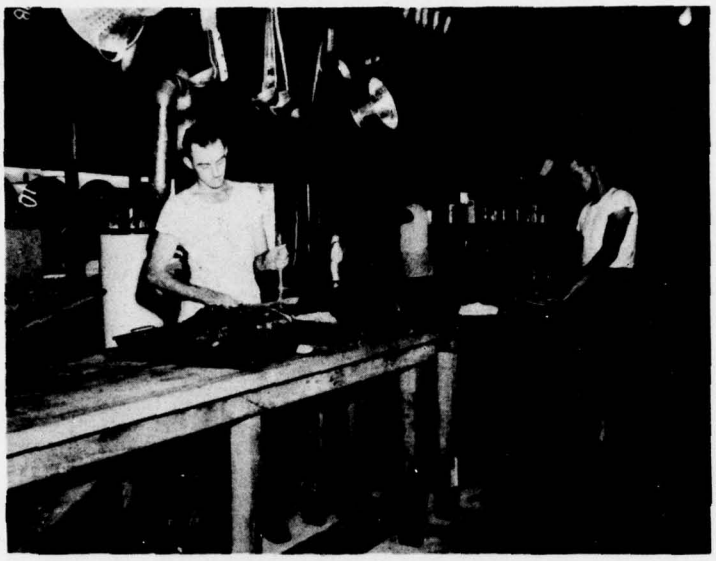

Figure 31. SeaBee galley on Bikini Island. ABCR Photo No. 5023-10.

Figure 32. Radio station KX6USN, set up on Bikini Island. ABCR Photo No. 5069-6.

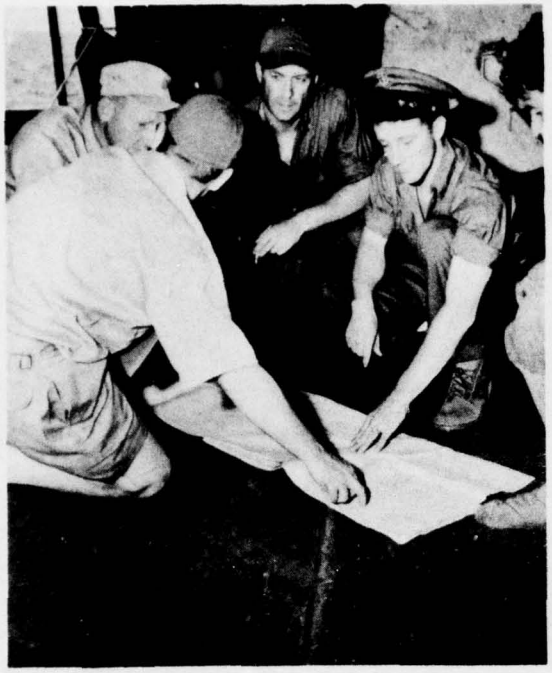

Figure 33. Briefing a diver aboard COUCAL (ASR-8) in the course of diving operations on sunken target ships. ABCR Photo No. 5022-2.

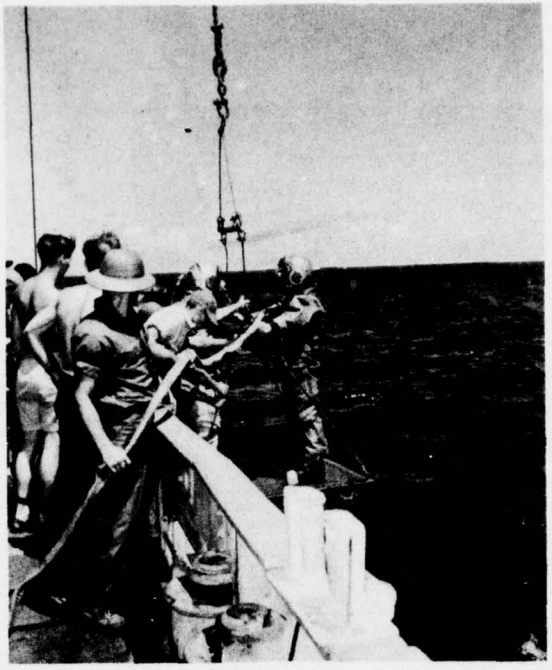

Figure 34. Deep diver being hoisted aboard COUCAL (ASR-8). ABCR Photo No. 5018-10.

Figure 35. Ready to begin the first drilling operation on Bikini Island. Left to right: Mr. E.L. ALEXANDER, Dr. H.S. LADD, CDR ROGER REVELLE, Dr. R.D. RUSSELL, CAPT C.L. ENGLEMAN, and Mr. V.C. MICKLE. Failing portable drilling rig No. 1500 in background. ABCR Photo No. 5020-8.

Figure 35. Ready to begin the first drilling operation on Bikini Island. Left to right: Mr. E.L. ALEXANDER, Dr. H.S. LADD, CDR ROGER REVELLE, Dr. R.D. RUSSELL, CAPT C.L. ENGLEMAN, and Mr. V.C. MICKLE. Failing portable drilling rig No. 1500 in background. ABCR Photo No. 5020-8.

Figure 36. CAPTAIN T.H. HEDERMAN, USN, throwing the first ball to open the season of the Bikini Soft-Ball League. Regular games were scheduled among the X-Ray Division and Divisions of ships' companies. Other recreational facilities included volleyball, tennis, basketball, and badminton. An officers' club, a CPO club, and an enlisted men's club were operated on Bikini Island. ABCR Photo No. 5030-10.

Continuing inspections of islands making up Bikini Atoll tended to confirm the initial impression that they were devoid of human occupants since Operation Crossroads. A domestic dog and three domestic cats were found on Bikini Island, and some domestic chickens on Enyu Island. It was apparent, however, that these animals had not been living under domestication for some time past, although the dog was captured in a box trap and soon became quite tame.

The eating of fruits, fish, or other materials grown in or about Bikini Lagoon, swimming, or the drinking of water from any island source had been prohibited since the day of the initial landing (see Appendix D, pg. 100). A Radiological Health Advisory Board had been established (see Appendix D, pg. 95) to pass upon all matters pertaining to radiological health. Acting upon the advices of this Board, Commander, Task Group 10.12 opened limited Bikini Island recreation areas on 19 July 1947. On 21 July 1947 he lifted the ban on swimming along certain beach areas, and on 24 July 1947 permitted the eating of edible fruits grown on Bikini Island. The ban on eating fish or other marine organisms remained, however, and all hands were warned to avoid unnecessary contact with barges, rafts and buoys in Bikini Lagoon, and with lines, fenders, life rafts, gratings, fuel oil, residues and other debris on the beaches. Figure 36 shows Commander, Task Group 10.12 throwing the first ball in the opening game of the softball league.

On 26 July 1947 Commander, Task Group 10.12 forwarded a dispatch to CinCPac-Flt requesting that LCI(L)-615 be retained for the duration of the resurvey, in view of developments with respect to the study of submarine geology in Bikini Lagoon, and that a landing ship medium be assigned to Task Group 10.12, to be used in conducting further resurvey operations, and for purposes of transporting specimens to San Diego. On 30 July 1947 ComServPac ordered LSM-382 to report to ComBikResurvGroup 10.12 as soon as practicable. Latona (AF-35) arrived in Bikini Lagoon on 28 July 1947 and departed on the same date, having transferred supplies to Chilton (APA-38).

On 26 July 1947 one LCVP returning from Coucal (ASR-8) to Chilton (APA-38) sank suddenly when 1,000 yards astern of Chilton (APA-38), due to failure of its ramp mechanism. Personnel were uninjured, and were soon picked up by another craft. An underwater camera which went down with the LCVP was recovered floating on the surface the following day.

On 30 July 1947 plans were initiated to establish a Return Logistics Board consisting of Commander R. S. Brookings, Lieutenant Colonel C. E. Grant, Lieutenant Commander R. L. Reaser, and Lieutenant D. M. Carr, U.S.N. This Board was created in recognition of the fact that a good deal of scientific gear would have to be shipped back to various institutions in the United States upon completion of the resurvey. It was the function of the Board to establish a packaging and shipping room aboard Chilton (APA-38), and in general to supervise the assembling and packaging of materials to be shipped prior to arrival at San Diego.

Mr. R. E. Frazier of the Cornell Aeronautical Laboratory, Buffalo, New York, joined the resurvey on 31 July 1947, for purposes of installing and operating underwater television gear. He was accompanied by Mr. K. D. Swartzal of the same institution, who, after conferring with the Project Officer, returned to the United States. The Director of Ship Material and the Construction Officer immediately began the work of installing television gear in the No. 1 hold of Coucal (ASR-8), for purposes of making surface observations of sunken ships. Mr. J. P. Gould of the Cornell Aeronautical Laboratory arrived to assist in this work on 2 August 1947.

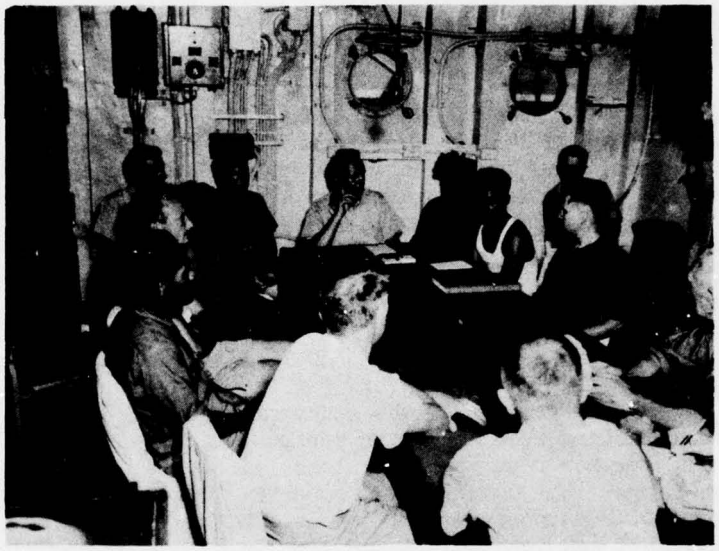

Figure 37. The Project Officer and scientists confer with Magistrate Juda and a group of his associates aboard CHILTON (APA-38). After an extensive tour of Bikini Atoll, the natives reported that they found it unchanged except for the introduction of papaya. ABCR Photo No. 5057-11.

On 1 August 1947 Ensign F. J. Jablonski departed Bikini for Kwajalein to act as personal representative of the Project Officer on LSM-382.

In order to make a series of control observations, and at the invitation of AtComKwajalein, a group of scientists and Staff Officers accompanied Commander, Task Group 10.12 and the Project Officer to Kwajalein on 2 August 1947, and remained through the following day. A seminar meeting was conducted at Kwajalein, with Commander, Task Group 10.12 presiding, in which members of the Bikini Scientific Resurvey participated as follows:

Dr. R. D. Russell, "The Geology of Bikini"
Lieutenant Commander F. B. Ewing, "Deep Sea Inspection"
Dr. D. M. Whitaker, "Reproduction of Marine Invertebrates"
Lieutenant Colonel C. E. Grant, "Radiological Safety"
Dr. L. R. Donaldson, "Effects of Radioactivity on Living Tissue"
Commander H. S. Etter (MC), "Radiological Health"
Dr. L. P. Schultz, "Fishes of the Marshall Islands"

While at Kwajalein CTG 10.12, the Project Officer and a number of scientists attended the formal opening and dedication of the native church. The Project Officer arranged for a number of inspection trips, including one to the windward reef. Similarly, an inspection party visited the sunken target ship Prinz Eugen on 2 August 1947, and collected some samples of fish, oysters, and algae which were brought back to Chilton (APA-38) to be tested for radioactivity. The group of scientists making these inspections at Kwajalein returned to Bikini on 4 August 1947.

LSM-382, commanded by Lieutenant (j. g.) R. H. Hughson joined Task Group 10.12 in Bikini Lagoon on 5 August 1947, bringing supplies for the drillers and gear for Coucal (ASR-8) and LCI(L)-615. On the same date diving operations on Saratoga were concluded, and Coucal (ASR-8) moved to a new mooring over sunken Pilotfish. The second drill hole was abandoned on 6 August 1947 at a depth of about 1,346 ft, and the drill rig was moved to a new location on Bikini Island, where a third drilling operation was begun (hole 2B).

On 6 August 1947, a native magistrate, Judah, and three of his Alaps (subchiefs) were brought to Bikini by courier plane. They represented the group of islanders who were evacuated to Rongerik in March 1946 to make way for Operation Crossroads. The Technical Director spent several days with these natives and an interpreter sent up from Kwajalein, touring the various islands of Bikini Atoll, the purpose being to determine whether the natives would detect any changes in their home environment. The only change they appeared to notice was that a new fruit-bearing plant, papaya, was in evidence. It is believed that seeds of this plant reached Bikini during the course of Operation Crossroads. Figure 40 shows the Project Officer and a group of representative scientists interviewing the natives through the medium of a native interpreter. Judah is seated at the left.

Before their departure, Judah and his associates were interviewed by the Project Officer and several of the leading scientists. They proved to be of considerable help to Dr. Shultz in proving common native names for a number of fishes collected in the vicinity. They reiterated, however, their conviction that there were no observable changes in the Bikini environment. The natives were flown out of Bikini on 11 August 1947.

Captain Walter Karig, U.S.N., of the Office of the Secretary of the Navy arrived via courier plane to visit Task Group 10.12 on 6 August 1947, spent two

days aboard Chilton (APA-38), visited the sites of various operations being conducted by the resurvey group, and discussed the nonclassified details of work in progress with officers and scientists.

Alstede (AKS-48) arrived in Bikini Lagoon on 8 August 1947, transhipped fresh foods to Chilton (APA-38), and departed enroute Saipan on the same date.

On 11 August 1947, LSM-382, with a number of the Scientific Staff aboard and with three picket boats in company, departed Bikini for Rongerik Atoll. Studies of a radiologically uncontaminated atoll were begun, in order to provide for possible comparisons with conditions found at Bikini. A courier-plane shuttle service was set up at once to include Kwajalein, Rongerik and Bikini, for purposes of transporting passengers, mail, and freight. Ensign F. J. Jablonski continued to act as representative of the Project Officer aboard LSM-382.

On 13 August 1947, Commander Task Group 10.12, in a dispatch to CinCPacFlt, recommended that Chilton (APA-38) depart Bikini Atoll enroute San Diego via Pearl Harbor about 30 August 1947; that Coucal (ASR-8) proceed to Pearl Harbor about 30 August 1947; that LSM-382, when ready for sea about 28 August 1947 be routed from Kwajalein to San Francisco by ComServPac; and that LCI(L)-615 report at AtComKwaj for duty about 30 August 1947. An affirmative reply was dispatched by CinCPacFlt on 14 August 1947, and CTG 10.12 informed units of his command of his intention "...to terminate all operations at Bikini on Saturday, 30 August...".

Mr. J. P. Chernock of the Geo-Technical Corporation, Dallas, Texas, joined the Scientific Staff on 15 August 1947, for purposes of making seismographic soundings of the two deep drill holes on Bikini Island. Lieutenant (j. g.) William Solonchak relieved Lieutenant (j. g.) W. E. Keeler as Commanding Officer of LCI(L)-615 on 16 August 1947, and on the same date Lieutenant (j.g.) Walter Getz became Executive Officer of LCI(L)-615.

On orders from Commander Task Group 10.12, LSM-382 departed Rongerik on 15 August 1947, and proceeded to Kwajalein to load gasoline. LSM-382 arrived alongside Chilton (APA-38) in Bikini Lagoon on 17 August 1947, transferred gasoline to the latter ship, and departed for Rongerik on the same date.

Divers from Coucal (ASR-8) completed their final inspections of Pilotfish on 16 August 1947, whereupon moorings were broken at once, and Coucal (ASR-8) moved to a position over Apogon, upon which dives were made on the same date.

LCI(L)-615 was out in the area Northwest of Bikini Atoll on 18-20 August 1947 carrying out dredging operations for the benefit of the Submarine Geologists. The Project Officer visited operations at Rongerik on 21 August 1947, and returned on 22 August 1947. Drill hole No. 3 was begun on the Southeastern end of Bikini Island on 21 August 1947, the drillers taking core samples at 10-foot intervals.

Mr. T. S. Austin of Navy Hydrographic Office, Washington, D. C., reached the survey site on 20 August 1947, to participate in the investigations concerned with the chemistry of sea water.

Underwater television gear aboard Coucal (ASR-8) was put in functional condition on 22 August 1947. A complete account of its operation will be found in Volume III of this report. Figure 44 shows a marine fish photographed upon the television screen. The equipment consisted of a naval aircraft television camera and monitor especially adapted for the work by the Cornell Aeronautical Laboratory of Buffalo, N. Y. Lieutenant Lloyd Everingham, U.S.N. arrived on 25 August

1947 to assist in installation and operation of the television gear. Lieutenant E. L. Schmitt, U.S.N., joined the resurvey of the same date, for purposes of carrying out bacteriological studies.

On 25 August 1947 securing of shore establishments and loading, as described in Section 2.019, was begun. Coucal (ASR-8) completed diving operations on Apogon, and made several dives on Nagato; then returned to Saratoga for a final inspection. Deep diving was scheduled for completion on 27 August 1947.

The attention of all participants in the Bikini Scientific Resurvey was again called to certain security matters by the Project Officer, who circulated a memorandum entitled "General Guide on Security of Matters Pertaining to the Bikini Scientific Resurvey". This memorandum is reproduced as Appendix F.

LSM-382 completed all assignments at the resurvey site, loaded, and departed enroute Kwajalein, Pearl Harbor, and San Francisco on 26 August 1947. She was carrying a picket boat, a DUKW, and two reefers filled with scientific specimens. LCI(L)-615 similarly completed operations at Bikini, and departed enroute Kwajalein on 29 August 1947.

Chilton (APS-38) was loaded, and in all respects ready for sea at 1000 on 29 August 1947. The Project Officer made a final inspection of secured installations on Bikini Island at this time, and ship musters were held to assure that all civilian and military personnel were properly accounted for. The last courier plane for Kwajalein embarked passengers and loaded mail. Upon orders of CTG 10.12, Chilton (APA-38) steamed out through Enyu Passage enroute Pearl Harbor.

2.016 Communications at Bikini

Communications while Task Group 10.12 was in the Bikini area were under the direction of Lieutenant (j. g.) J. A. Walker, Communication Officer of Chilton (APA-38). Under the direction of Lieutenant Junior Grade J. L. Greiner, communication equipment was installed in each craft employed in the resurvey operation, and two installations were made on Bikini Island. LCI(L)-615 was equipped with portable sonar sounding gear. Portable communication equipment was provided for work parties going ashore on islands other than Bikini. In general, crews of boats or special work parties away from the guard ship were required to make radio contact every hour.

The overall purpose of the Communication Plan (see Appendix D, pg. 88) was to maintain normal radio contacts with major naval communication centers, carry out all other duties regularly assigned to a ships' communication organization, and at the same time meet the special communication and safety requirements of Task Group 10.12 and the Scientific Groups attached thereto.

Specific activities of the communication organization were as follows:

A. Maintained (from Chilton (APA-38) normal radio communication with Honolulu and Kwajalein, guarded Honolulu Fox schedule, maintained radio guard on a 500 kc distress frequency, and acted as radio guard for Coucal (ASR-8) and LCI(L)-615.

B. Established a special communication network at Bikini, with headquarters aboard Chilton (APA-38), as indicated above.

C. Maintained visual signal watch when required; signalmen being utilized on voice radio watches.

D. Maintained air search to track the flight of courier planes to and from Kwajalein, holding surface search available to be used as required.

E. At six hour intervals, reported weather conditions at Bikini Lagoon to Pearl Harbor and Kwajalein.

F. Decrypted and disseminated all general messages for Task Group 10.12.

G. Operated all post office facilities for Task Group 10.12.

At the direction of the Project Officer, and with the assistance of the Electronics Coordinating Officer, amateur radio station KX6USN (see fig. 32) was installed on Bikini Island by Mr. E. H. Shulur. The six operators of KX6USN succeeded in establishing communication with amateur operators in nearly all of the 48 States, and in several foreign countries. In their recreational time these operators made a total of 742 different contacts.

For recreational purposes, the Electronics Coordinating Officer installed a ships' broadcasting station in Chilton (APA-38). This station broadcasted to all hands in Task Group 10.12 for about 13 hours daily on a frequency of 1,000 kc, being operated as indicated in Section 2.008.

2.017 Photography at Bikini

Photography at Bikini Atoll was represented by two distinct phases: surface photography and underwater photography. This Section of the Technical Report deals primarily with the first-named phase; underwater photography is described in Volume III.

The photographic laboratory, under supervision of Lieutenant (j. g.) Arvel Heath, the Photography Officer, was set up in Chilton (APA-38), as detailed in Section 2.006. This laboratory was the photographic center for the Bikini Scientific Resurvey, processed most of the black-and-white still film employed in the course of operations, and made contact prints and enlargements as required by the Project Officer. Security measures were carried out in accordance with Annex H of the Operation Plan (see Appendix D, pg. 91).

The surface phase of photography was concerned with making as complete a photographic record of the Bikini Scientific Resurvey as possible. This, in turn, involved supplying pictures to document the work of various Scientific and Military Groups, pictures for press releases, and illustrations which ultimately were incorporated in the Technical Report. Motion picture film and color film were forwarded to Naval Photographic Center, Naval Air Station, Washington, D. C., to be processed and otherwise dealt with as described in Annex L of the Operation Plan (see Appendix D, pg. 111).

2.018 Scientific Group Activities at Bikini

Scientific Group activities at the resurvey site began the day Chilton (APA-38) dropped anchor in Bikini Lagoon, and were extended as rapidly as preliminary monitoring operations could be concluded. On 16 July 1947, scientists were collecting marine plants and animals on and about the reefs of Prayer Island and Bikini Island, and the following day pelagic fishing was begun. Meanwhile, the Geological Group was supervising the first drilling operation, making a preliminary survey of reef growth of the seaward side of Bikini Island, and preparing to initiate the study of bottom sediments. Aboard Chilton (APA-38) the various laboratories, including the Counter Room, the Radiobiology Laboratory; and the

Figure 38. One corner of the Geology Laboratory on Bikini Island. Note specimens of reef-building organisms on the table. ABCR Photo No. 5029-4.

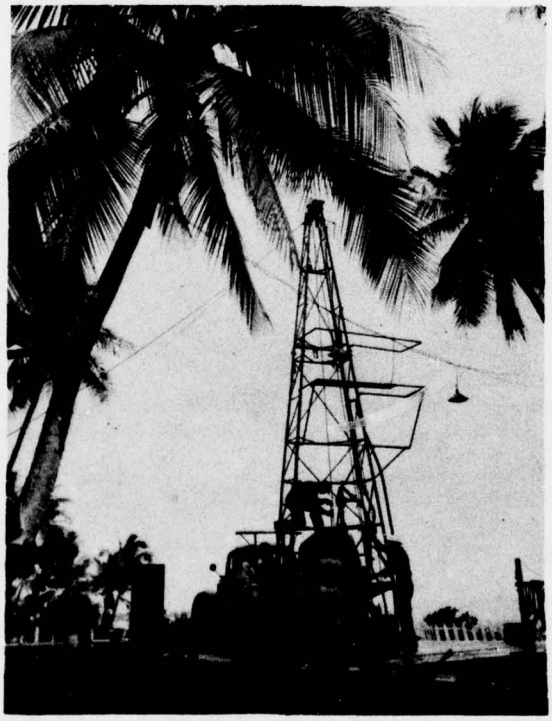

Figure 39. Portable drilling rig of the G.E. Failing Co., being operated at Hole No. 2 on Bikini Island. ABCR Photo No. 5048-3.

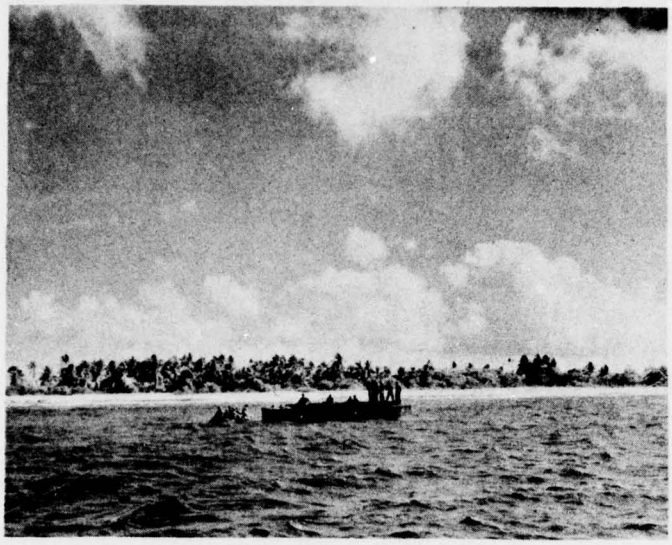

Figure 40. Members of a landing party using a rubber boat to reach the beach of UKO Island. Due to the presence of extensive underwater coral growths, such tactics had to be employed in many situations. ABCR Photo No. 5026-1.

Figure 41. Scientists picking up fish in an area where poison has been placed in the water. This method was employed to obtain samples of different species and also in making population counts. ABCR Photo No. 5026-9.

Radiochemistry Laboratory were busy, as specimens and samples began to arrive, and analyses were begun. Added laboratory facilities were being set up on Bikini Island, as indicated in Section 2.006.

Planning conferences were held aboard Chilton (APA-38) each evening except Saturday, and a work plan for the following day prepared. This plan provided for the boat and service needs of the Scientific Groups, who left the ship according to regular schedule. Regular radio contact with the guard ship was maintained by working parties on the islands and reefs, as detailed in Section 2.016. All specimens brought aboard Chilton (APA-38) were either monitored or packaged before arrival, to prevent ship contamination, and any working parties going into untested areas were accompanied by monitors.

On the average working day, a geological party would be out studying one of the reef structures and taking samples which were duly returned to the laboratory on Bikini Island for further study (see fig. 38). Meanwhile, drilling operations designed to furnish additional geological information would be proceeding on Bikini Island as shown in figure 39; and the Submarine Geologists would be taking cores and samples from the bottom of Bikini Lagoon.

On the same day, two or three groups of scientists, including members of the Radiobiology and Fisheries Groups would . at different locations along the reefs of Bikini Atoll, either collecting sample specimens for purposes of determining the existing degree of radioactivity, or conducting studies concerned with habitats, food chains, and taxonomic relationships. Many of the localities where such studies were carried on proved to be relatively inaccessible because of the coral growths beneath the surface; in such cases rubber boats (see fig. 40) and wherries proved to be invaluable items of equipment.

Scientists studying fishes commonly employed a technique of spreading rotenone through the water along a reef margin to kill or paralyze the fish. Figure 41 shows a group of scientists picking up fish in a "poisoned" area. Picket boats manned by commercial fishermen of the Fish and Wildlife Service conducted almost daily pelagic fishing operations, taking specimens from the deeper waters of the open sea for the most part.

Other Scientific Groups visited the islands and reefs almost daily to collect specimens of algae, sea urchins and other marine invertebrates, insects, lizards, birds, and mammals. Many of these specimens were returned to laboratories on Chilton (APA-38) or on Bikini Island where they were studied from the standpoint of possible radiological or blast effects upon structure, physiological processes, fertility or normal processes of development; and from the standpoints of ecological and taxonomic relationships. Figure 42, for example, shows a manta ray being skinned and otherwise dissected on the deck of Chilton (APA-38).

Other regular or occasional activities included making plankton hauls from Bikini Lagoon, studying samples of sea water from various locations, and conducting shallow-water diving activities to obtain all sorts of marine specimens. Figure 43 shows an LCM equipped with shallow-water diving gear, which was used to secure specimens for a number of the Scientific Groups.

Army Engineer Corps and Aerology Groups made observations and measurements appropriate to the studies they had undertaken, and Radiological Safety Officers carried out a comprehensive survey of radioactivity on the reefs and islands of Bikini Atoll. Divers from Coucal (ASR-8) were engaged in the inspection of sunken target ships.

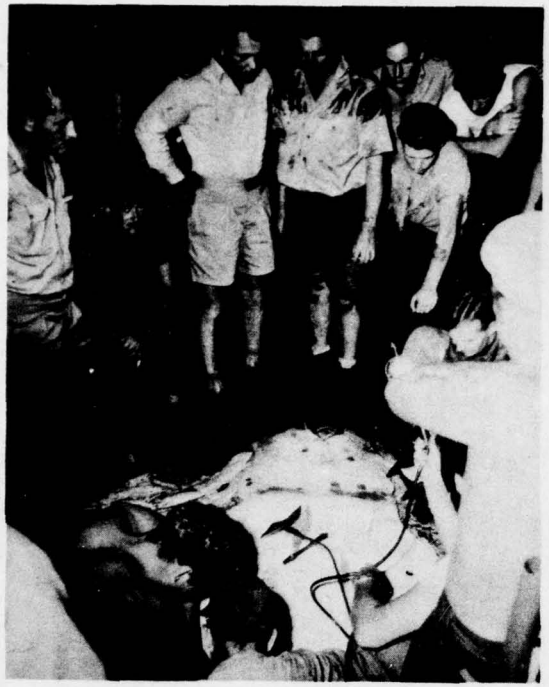

Figure 42. A large manta ray being skinned on the deck of CHILTON (APA-38). Note the bent harpoon, which was used in capturing this animal. ABCR Photo No. 5024-11.

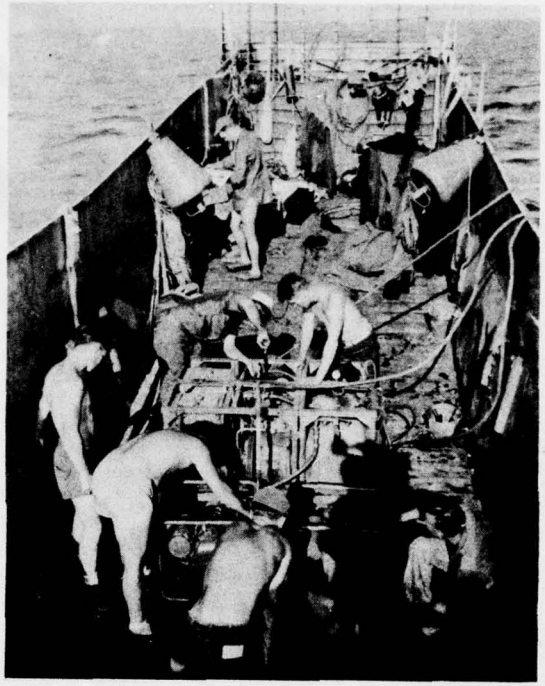

Figure 43. An LCM with shallow-water diving gear aboard. Divers are checking the compressors and getting the gear in a state of readiness. ABCR Photo No. 5045-10.

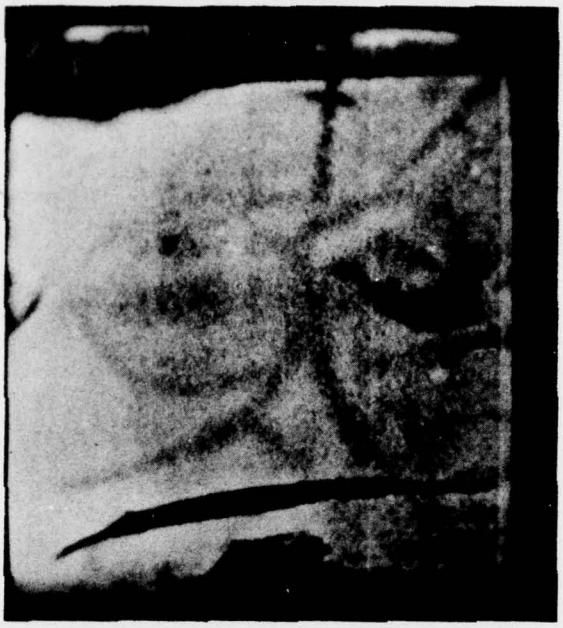

Figure 44. Photograph of underwater television screen, showing a needlefish in the water 160 ft. below. ABCR Photo No. 5081-3.

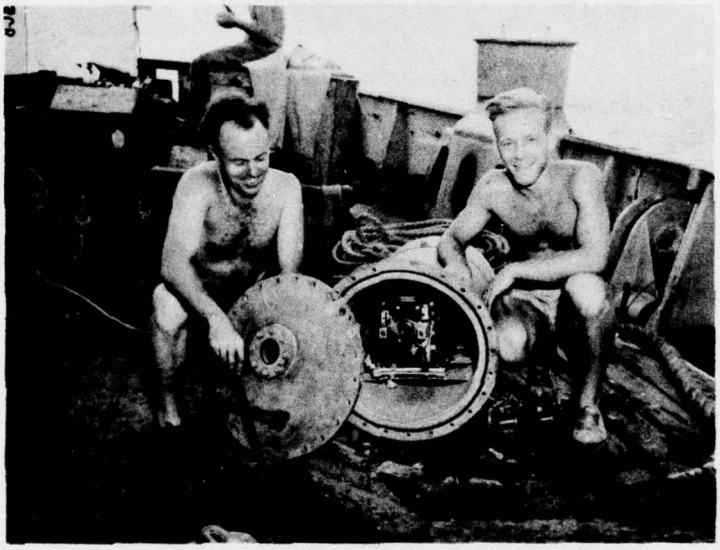

Figure 45. Representatives of Cornell Aeronautical Laboratory with television camera and underwater case. ABCR Photo No. 5082-6.

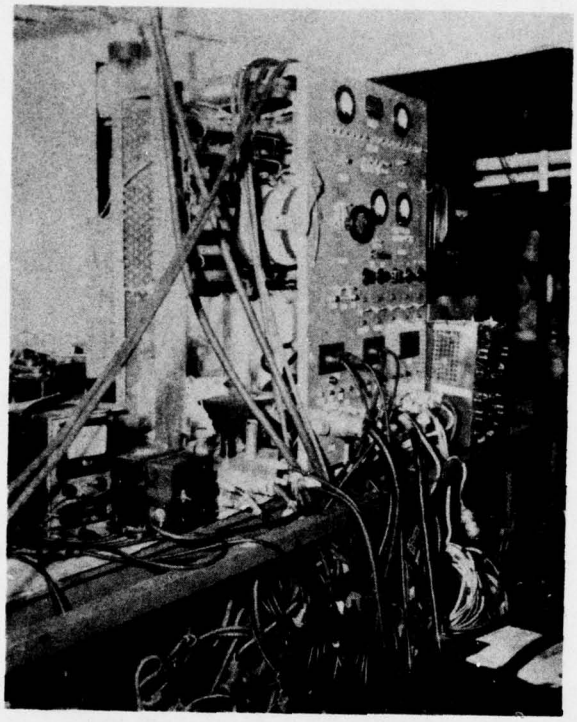

Figure 46. Underwater television unit set up in compartment aboard COUCAL (ASR-8). ABCR Photo No. 5082-11.

The Radiochemistry and Radiobiology Laboratories and the Counter Room aboard Chilton (APA-38) were busy a large part of the time, conducting examinations, dissections, and analyses. Scientists who worked in them not only conducted their own studies, but also provided special services for scientists of other groups.

For a two week period during the latter part of the Bikini Scientific Resurvey LSM-382 was stationed at Rongerik Atoll, and courier-plane service was established between that locality and Bikini Atoll. During this two week period most of the Scientific Groups sent representatives to Rongerik, where specimens were collected in a radiologically uncontaminated environment for comparison with those taken at Bikini.

From day to day, the various Scientific Groups were visited in the field and the laboratory by the Project Officer and the Technical Director. Many formal and informal conferences were held during and after working hours. Several meetings of the Advisory Board (see Section 2.007) were convened while at Bikini, for purposes of making oral comparisons of group progress, and by way of meeting current problems.

On 15 August 1947 a Medical Legal Board was appointed by the Project Officer, and charged with the responsibility of determining whether any personnel connected with the resurvey had been "...exposed to radiation exceeding the accepted safe standards." This board was constituted as follows: Dr. F. H. Rodenbaugh, Sr. (M.D.), Chairman, Lieutenant Colonel C. E. Grant, Lieutenant Colonel G. A. Heffernon, Commander H. S. Etter, Dr. J. H. Roberson, Lieutenant Colonel E. C. Paules, and Dr. P. M. Brooks. Conferences were held by this group, and its report was filed with the Project Officer on 27 August 1947, and is here reproduced as Appendix G. The Board indicated that to the best of their knowledge and belief "...no individual assigned to, attached to, or participating in the Bikini Scientific Resurvey operations...was exposed to radiation in excess of the accepted standards."

The detailed activities and results of the various Scientific Groups are recorded in Volume II of this report, subject to the qualification that some investigations, by virtue of their special nature, could not be completed at Bikini, either because special equipment was required or because time did not permit. It is understood that in such cases more complete and final reports will be filed with appropriate authority by the Scientific Groups involved.

2.019 Evacuation of Bikini

Active preparations for the evacuation of the resurvey site were begun on 22 August 1947 when return logistics of laboratories were discussed in a meeting of the Advisory Board. On the following day, Staff Department Heads met with the Project Officer, and a plan for securing the SeaBee camp and the laboratories on Bikini Island was drawn up. Under this plan, loading and securing operations were scheduled to begin on 25 August 1947, and to be concluded on 29 August 1947. A Survey Board composed of Commander R. S. Brookings, Commander J. R. Denny, and Lieutenant (j.g.) B. D. Lamar was appointed.

Drilling equipment was secured and loaded on 24 August 1947. On the following day the equipment in the Geology, Aerology, and one of the Biology Laboratories was put aboard Chilton (APA-38), as well as gear from the enlisted men's club and the officers' club. On 26 and 27 August 1947 the remaining Biology Laboratory was closed and SeaBee gear was secured. On 29 August the SeaBee

Figure 47. Monitoring the bow of CHILTON (APA-38) just prior to departure from Bikini Lagoon. ABCR Photo No. 5108-7.

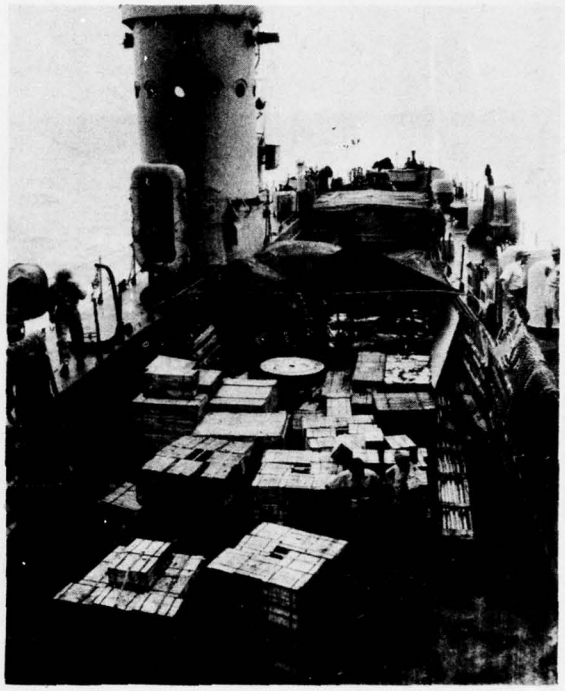

Figure 48. LSM-382 delivering a cargo of scientific gear and supplies on the beach of Bikini Island. ABCR Photo No. 5042-2.

galley, mess hall and cooks' bunk house were secured, and the following morning all remaining gear was moved aboard Chilton (APA-38). All buildings on Bikini Island were secured, and the occupied area was left in clean and orderly condition. A final inspection was made by the Project Officer immediately prior to sailing on 29 August 1947.

2.020 Activities Enroute San Diego

On 30 August the Project Officer originated a dispatch to the Chief of the Armed Forces Special Weapons Project (300736Z) requesting that photographs taken in the course of the resurvey, except those showing target ships or underwater views be released from security (declassified). This permission was granted on 3 September 1947 by Chief, Armed Forces Special Weapons Project dispatch 030046Z.

Chilton (APA-38) arrived at Pearl Harbor on 3 September 1947. Prior to arrival, the detachment of Commander, Task Group 10.12 had been ordered (CinCPacFlt dispatch 040322Z) so that he might proceed by air to the mainland and assume immediate command of Destroyer Flotilla One. Task Group 10.12 was dissolved at Pearl Harbor on 4 September 1947, Captain T. H. Hederman hauling down pennant in Chilton (APA-38) on that date.

Certain civilian scientists and military personnel including CBD 1800 were disembarked from Chilton (APA-38) at Pearl Harbor, according to plan, gear was unloaded, and fuel was taken aboard. The Project Officer and members of his Staff called upon CinCPacFlt, where, at the request of CinCPacFlt, the Project Officer gave a presentation of operations conducted in the course of the Bikini Scientific Resurvey. 1st Lieutenant H. H. Porter, U.S.A. reported aboard Chilton (APA-38) on 4 September 1947, for purposes of taking fingerprints, and was detached on 5 September 1947. Lieutenant (j.g.) B. D. Lamar was sent to San Diego via air to arrange with Commandant, Eleventh Naval District, as to unloading and disposal of gear at that port.

Chilton (APA-38), under operational control of ComServPac, being in all respects ready for sea, departed Pearl Harbor on 5 September 1947, and proceeded to San Diego. Several Staff conferences were held enroute, which were concerned with details of returning scientific gear to institutions from which it had been borrowed, and with the preparation of reports.

APPENDIXES

A: Joint Chiefs of Staff Memoranda to Secretary of the Navy and Secretary of War, dated 16 May 1947

B: Chief of Naval Operations Directive to Commander-in-Chief, Pacific Fleet, dated 2 June 1947

C: Commander-in-Chief, Pacific Fleet, Operation Order No. 101-47, dated 28 June 1947

D: Operation Plan, ComBikResurvGroup No. 1-47

E: Radiological Safety Officer's Memorandum to Project Officer on results of initial monitoring operations, dated 16 July 1947

F: Project Officer's memorandum to the Scientific Staff, entitled "General Guide on Security Matters Pertaining to the Bikini Scientific Resurvey," dated 27 August 1947

G: Report of the Medical Legal Board to the Project Officer, dated 27 August 1947

COPY

APPENDIX "A"

THE JOINT CHIEFS OF STAFF
Washington 25, D. C.

RESTRICTED

16 May 1947

MEMORANDUM FOR THE SECRETARY OF THE NAVY:

Subject: Scientific Resurvey of Bikini.

In accordance with a recommendation of the Joint Crossroads Committee, it is requested that a scientific resurvey of Bikini Atoll be undertaken by the Navy Department during summer of 1947 in order to complete studies and projects begun in 1946 in connection with Operation Crossroads. It is further requested that the services of the Joint Crossroads Committee or its successor be used for technical supervision of the resurvey.

The resurvey would entail the collection of biological specimens, diving on target ships to recover specific instruments and to make certain structural examinations, the taking of water and bottom samples and cores, and radiological studies of the lagoon, the surrounding islands and organisms with particular reference to analysis of hazards from Alpha radiation and from possibly contaminated food organisms. A target date of 15 July 1947 for commencing operations at Bikini is proposed.

The Joint Crossroads Committee will furnish such technical advice and assistance as may be needed in planning and conducting the survey. It is anticipated that the U. S. Geological Survey, the Fish and Wildlife Service of the Department of the Interior, and the National Museum will desire to participate in the scientific work of the expedition.

The War Department is being requested (Enclosure) to cooperate with the Navy in this resurvey of Bikini and to furnish such facilities and personnel as may be needed and could be made available.

For the Joint Chiefs of Staff:

WILLIAM D. LEAHY
Fleet Admiral, U. S. Navy
Chief of Staff to the
Commander in Chief of the Army and Navy

Enclosure:
cc: Chief, P&P Grp, P&O
Adm. Aide to CNO
Secretary of War
Col. J.W. Bowen
Capt. W.R. Hollingsworth, USN

THE JOINT CHIEFS OF STAFF
Washington 25, D. C.

COPY

RESTRICTED

16 May 1947

MEMORANDUM FOR THE SECRETARY OF WAR:

Subject: Scientific resurvey of Bikini.

In accordance with a recommendation of the Joint Crossroads Committee, the Navy Department has been requested (Enclosure) to undertake a scientific resurvey of Bikini Atoll during the summer of 1947 in order to complete studies and projects begun in 1946 in connection with Operation Crossroads. It has further been requested that the services of the Joint Crossroads Committee or its successor be used for technical supervision of the resurvey.

The resurvey would entail the collection of biological specimens; diving on target ships to recover specific instruments and to make certain structural examinations; the taking of water and bottom samples and cores; and radiological studies of the lagoon, the surrounding islands and organisms, with particular reference to analysis of hazards from alpha radiation and from possibly contaminated food organisms. Approximately twenty scientific and technical personnel will be required. A target date of 15 July for commencing operations at Bikini Atoll is proposed.

The Joint Crossroads Committee will furnish technical advice and assistance in planning and conducting the survey. It is anticipated that the U.S. Geological Survey, the Fish and Wildlife Service of the Department of Interior, and the National Museum will desire to participate in the scientific work of the expedition.

It is requested that the War Department cooperate with the Navy in this resurvey of Bikini, and furnish such facilities and personnel as may be needed and can be made available.

For the Joint Chiefs of Staff:

WILLIAM D. LEAHY
Fleet Admiral, U. S. Navy
Chief of Staff to the
Commander in Chief of the Army and Navy

Enclosure:
Copies to: Chief, P&P Grp, P&O
Adm. Aide to CNO
Secretary of the Navy
Col. J. W. Bowen
Capt. W.R. Hollingsworth, USN
(JCS 1766/a - approved 16 May 1947)

COPY

APPENDIX "B"

2 June 1947

Op 36B/cmf
Serial: 176P36
File: All

RESTRICTED

From: Chief of Naval Operations.
To : Commander-in-Chief, Pacific Fleet.
Chief of the Bureau of Ships.
Chief of the Bureau of Ordnance.
Chief of the Bureau of Aeronautics.
Chief of the Bureau of Medicine & Surgery.
Chief of the Bureau of Supplies & Accounts.
Chief of the Bureau of Yards & Docks.
Chief of Naval Personnel.
Chief of Naval Research.

Subj: Scientific Resurvey of Bikini Atoll.

1. In accordance with a request of the Joint Chiefs of Staff, a scientific resurvey of Bikini Atoll will be undertaken during the summer of 1947 in order to complete studies and projects begun in 1946 in connection with Operation Crossroads.

2. Among the projects to be undertaken will be the collection of biological and geological specimens, diving on target ships to recover specific instruments and to make certain structural examinations, the taking of water and bottom samples and cores, and radiological studies of the lagoon, the surrounding islands and organisms.

3. The resurvey will be carried on under the operational control of the Commander-in-Chief, Pacific Fleet. The Joint Crossroads Committee, or its successor organization, will furnish technical advice and supervision in planning and conducting the survey. Arrangements for supply of special equipment and for assignment of scientific and technical personnel will be made by the Bureau of Ships, in cooperation with other offices and bureaus. It is anticipated that the U.S. Geological Survey, the Fish and Wildlife Service of the Department of the Interior, the National Museum and the Atomic Energy Commission will desire to participate in the scientific work. The War Department has also been requested to cooperate with the Navy in this resurvey of Bikini and to furnish facilities and personnel as may be needed and can be made available.

4. A target date of 15 July 1947 for commencing the operations at Bikini Atoll is proposed.

/s/ Forrest Sherman
FORREST SHERMAN
Deputy Chief of Naval Operations
(Operations)

Copy to:
Chief, Armed Forces Special Weapons Project
Chairman, Joint Crossroads Committee
Chief of Staff, U.S. Army - Commanding General, AAF

APPENDIX "C"

COPY

A4-3(2)

THE PACIFIC COMMAND
AND UNITED STATES PACIFIC FLEET
HEADQUARTERS OF THE COMMANDER IN CHIEF

RESTRICTED

28 June 1947

Operation Order
CinCPacFlt No. 101-47

TASK ORGANIZATION

(a) 10.12 Bikini Resurvey Group - Captain Hederman

CHILTON (APA-38)(F)	1 APA
COUCAL (ASR-8)	1 ASR
LCI(L)-615	1 LCI(L)

CBD 1800 (1 officer and 36 enlisted men)
One Amphibian Type Plane

1. General Situation

CNO has directed that a scientific resurvey of Bikini Atoll be undertaken during the summer of 1947 with a target date of 15 July 1947 for commencing operations at Bikini Atoll. The Bikini Resurvey Group will be under the operational control of CinCPacFlt. The Armed Forces Special Weapons Project will furnish technical advice and supervision in planning and conducting the survey. Arrangement for supply of special equipment and for assignment of scientific and technical personnel will be made by the Bureau of Ships, in cooperation with other offices and bureaus. It is anticipated that the U.S. Geological Survey, the Fish and Wildlife Service of the Department of the Interior, the National Museum and the Atomic Energy Commisiion will desire to participate in the scientific work. The War Department has also been requested to cooperate with the Navy in this resurvey of Bikini and to furnish facilities and personnel as may be needed and can be made available. This operation order is based on CNO serial 176P36 of 2 June 1947, CNO dispatch 032224 of June, CNO dispatch 141552 of June 1947, CNO dispatch 181532 of June, and CNO dispatch 181745 of June.

2. This group will proceed to the vicinity of Bikini Atoll, to arrive on or about 15 July 1947, and will conduct a scientific resurvey of Bikini Atoll in order to complete studies and projects begun in 1946 in connection with Operation Crossroads. The Bikini Resurvey Group will:

(a) Examine specified target ships present in lagoon.
(b) Determine the amount and nature of the radioactivity in the lagoon water, bottom sediments, reef limestones, and island soils.
(c) Determine the concentration and effects of radioactivity in fish, marine plants and other organisms, including corals.
(d) Study the possible changes in population and morphology of fishes.
(e) Conduct basic physiological and related study of reefs and lagoon organisms.
(f) Obtain cores drilled in Bikini Island reef, in cooperation with U.S. Geological Survey, to depths of 300 to 2,000 feet.
(g) Comply with requests contained in Chairman Joint Crossroads Committee serial 476 of 4 June 1947.

A4-3(2) 28 June 1947
RESTRICTED
Operation Order - CinCPacFlt No. 101-47

(h) Conduct other related investigations as may be directed by proper authority.

3. (a) Chilton (APA-38), Commander Task Group 10.12 embarked, when in all respects ready for sea on 1 July 1947, depart San Diego and proceed to Bikini Atoll, via Pearl Harbor.

Coucal (ASR-8), with qualified diving personnel, and when ready for sea at Pearl Harbor, will report to CTG 10.12 for operational control upon the arrival of Chilton (APA-38) at Pearl about 6 July.

LCI(L)-615 will similarly report by dispatch on 12 July when ready for sea at Kwajalein.

(b) Upon completion of assigned tasks about 1 September and when directed by CinCPacFlt this Task Group will be dissolved and vessels assigned will be returned to the operational control of their respective Type Commanders.

4. Logistic support through Commander Service Force, Pacific Fleet, at Pearl Harbor.

5. Communications will be in accordance with PAC 70 B, except as noted below:

(a) Radio Honolulu (NPM) will guard 4235 series continuously, manual for ship to shore, unless traffic volume warrants establishment circuits A-6, duplex shipshore radio teletype.

(b) Guard Honolulu (NPM) broadcast HOW.

(c) While conducting the resurvey the Commander resurvey group will report by weekly summary dispatch, action CinCPacFlt, information CNO, and other interested commands.

LOUIS DENFELD

Annex

A. Bikini Resurvey Group Technical Staff.

Distribution

CNO (8)
WARCOS
CHIEF NAVAL RESEARCH (5)
POSTGRAD SCHOOL ANNAPOLIS
NATIONAL WAR COLLEGE
NAVAL WAR COLLEGE
ARMED FORCES STAFF COLLEGE
MARINE CORPS SCHOOLS, QUANTICO
BUSHIPS
COMGENAGFPAC
COMWESSEAFRON
COMSERVPAC
COMPHIBSPAC (AIRMAIL)
COMSUBPAC
COMAIRPAC
COMMARIANAS
COM 11
COM 14

A4-3(2) 28 June 1947
RESTRICTED
Operation Order - CinCPacFlt No. 101-47

BUMED
BUORD
BUPERS
BUAER
BUSANDA
BUDOCKS
COMGENAAFPAC
COMNAVBASE PEARL
ATCOM KWAJALEIN (5)
COMBIKINI RESURVEY GRU (3)
CHILTON (APA-38) (AIRMAIL) (3)
COUCAL (ASR-8) (AIRMAIL) (3)
LCI(L)-615 (AIRMAIL)
CHIEF, ARMED FORCES SPECIAL WEAPONS PROJECT, P.O. BOX 2610
WASHINGTON, D.C.

/s/ J.M. Lee
J. M. LEE,
Flag Secretary

RESTRICTED
TG 10.12/A16

BIKINI Resurvey Group
and Task Group 10.12
U.S.S. CHILTON (APA-38),
Flagship

OPERATION PLAN
ComBikResurvGroup No. 1-47

SAN DIEGO, CALIFORNIA
30 June 1947, 1100

TASK ORGANIZATION

(a) Task Group 10.12, Bikini Resurvey Group, Captain T.H. HEDERMAN

CHILTON (APA-38), Flagship	1 APA
COUCAL (ASR-8)	1 ASR
LCI(L)-615	1 LCI(L)
CB Detachment 1800	1 CBD
One Amphibious Type Plane	

1. Information.

The Joint Chiefs of Staff on 16 May 1947, requested the Secretary of the Navy to undertake a scientifit resurvey of Bikini Atoll during the summer of 1947, in order to complete studies and projects begun in 1946 in connection with Operation Crossroads. They further requested that the services of the Armed Forces Special Weapons Project be used for technical supervision of the resurvey. The resurvey is to be carried on under the operational control of the Commander-in-Chief, Pacific Fleet. The Bureau of Ships, in cooperation with other offices and bureaus, is arranging for supply of special equipment and for assignment of scientific and technical personnel. The War Department is cooperating with the Navy in this expedition. The Atomic Energy Commission, the U.S. Geological Survey, the Fish and Wildlife Service of the Department of the Interior, the Smithsonian Institute, and other scientific and educational institutions throughout the country also will participate. Other information is contained in annexes.

2. This Task Group will carry out the resurvey of Bikini Atoll by collection of biological and geological specimens; diving on target ships to recover specific instruments and to make certain structural examinations; taking water and bottom samples and cores; and by radiological studies of the lagoon, the surrounding islands and organisms.

3. (X) (1) Move to target area in accordance with Movement Plan (Annex A).

(2) This Plan is effective for planning and communication purposes upon receipt, and for resurvey purposes on 15 July 1947, upon arrival Bikini.

(3) Carry out the technical and scientific phases as directed by ComTaskGroup 10.12 and/or the Project Officer (Captain C.L. Engleman, USN) in Chilton (APA-38), in accordance with plans set forth in annexes.

4. Fuel and Provision before leaving present bases, on the premise that the Task Group will depart Bikini on 1 September 1947 for home bases via Pearl. Logistic support through Commander, Service Force, Pacific Fleet, at Pearl Harbor. Other logistics in accordance with Technical Logistics Plan (Annex G). Boat Pool in accordance with Boat Pool Plan (Annex M).

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OPERATION PLAN
ComBikResurvGroup No. 1-47

- -

5. Communications in accordance with Communication Plan (Annex F). Use zone minus twelve time at Bikini. Commander Bikini Scientific Resurvey Group and Task Group 10.12 in Chilton (APA-38).

T. H. HEDERMAN
CAPTAIN
Commander Bikini Resurvey
Group
and Task Group 10.12

Annexes

A. Movement Plan
B. Resurvey Plan
C. Technical Plan
D. Sunken Ship Inspection Plan
E. Electronics Plan
F. Communication Plan
G. Technical Logistics Plan
H. Security Plan
I. Photography Plan
J. Radiological Safety and Health Plan
K. Re-Entry Plan
L. Public Information Plan
M. Boat Pool Plan
N. Reports Plan
O. Typhoon Plan
P. Administrative Plan

Distribution

CNO (8)
CinCPac Flt (6)
AFSWP (12)
ComCLantFlt (1)
ComServPac (3)
ComWesSeaFron (1)
Com 12 (1)
Com 11 (1)
ComHawSeaFron (1)
ComNavBasePearl (1)
ComSubPac (1)
ComPhibsPac (1)
ComAirPac (1)
BuShips (3)
BuPers (1)
BuSandA (1)
BuMed (1)
BuDocks (1)
BuAer (1)
BuOrd (1)
ONR (5)
PubInfoNavDept (2)
OpDevFor (1)
ComMarianas (1)
AtComKwajalein (5)
Chilton (10)

[redacted]
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TG 10.12/A16

OPERATION PLAN
ComBikResurvGroup No. 1-47

ComGenAAFPac (1)
ComGenAGFPac (1)
Com 14 (1)
NavWarCollege (1)
Nat'lWarCollege (1)
Armed Forces Staff College (1)
Marine Corps Schools Quantico (1)
ComDesPac (1)

Coucal (3)
LCI (L)-615 (2)
Scientific Staff (1 ea)

ANNEX A

MOVEMENT PLAN

(a) Resurvey Group Flagship - USS Chilton (APA-38)-Depart San Diego, 1 July 1947; Proceed Bikini Atoll via Pearl Harbor to arrive at Bikini 15 July 1947.

(b) USS Coucal (ASR-8) - Depart Pearl Harbor so as to arrive Bikini 15 July 1947.

(c) LCI(L)-615 - Depart present base in time to arrive Bikini 15 July 1947.

ANNEX B

RESURVEY PLAN

I. General

To carry out the technical mission of the Task Group, Capt C.L. Engleman, USN, was designated by the Chief of Naval Operations as Project Officer of the Bikini Scientific Resurvey.

II. Mission

The technical mission of this Task Group is to observe, measure, and record all significant effects of Operation Crossroads on the organisms of Bikini Atoll and surroundings waters, on the atoll itself, and on the ships and equipment remaining there from Operation Crossroads; and to contribute to the body of fundamental science by observation, measurement and report on those aspects of oceanography, geology, biology, and nuclear physics that are of particular significance in this locale.

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This mission may be subdivided as follows:

A. To determine the amount and nature of radioactivity in the lagoon water, and in the reef and land structures of the atoll, wherever such radioactivity exceeds normal levels of natural radioactivity and cosmic rays. Particular attention will be paid to that portion of the reef between Amen and Bikini Islands. At a stage of the tide as nearly as possible that which occurred 15 minutes after the Baker explosion, the exposed portion of the reef will be charted by aerial photography.

B. To determine the concentration and kind of radioactive materials in the animals and plants of the atoll, and the effects of this radioactivity upon the organisms.

C. In order to gain information for better understanding of the possible biological and geological effects of Operation Crossroads, physiological, geological, and oceanographic studies of organisms and reef building processes will be made. These will include drilling cores down to 1,000 ft. and if possible to 2,500 ft.

III. Technical Organization

The organization of the Project Officer, the Departments, the Heads of the Departments, and the Annexes which control their operation are listed:

Captain C.L. Engleman, USN, Project Officer
Annex B

A. Technical Director, Commander E.S. Gilfillan, Jr., USNR,
Annex C

B. Director of Ship Material, Lieutenant Commander F.B. Ewing, USN,
Annex D

C. Radiological Safety Officer, Lieutenant Colonel C.E. Grant (Cml.C.), USA,
Annex J

D. Radiological Health Officer, Commander H.S. Etter (MC), USN,
Annex J

E. Technical Reports Officer, Lieutenant Commander F.L. Fitzpatrick, USNR,
Annex N

F. Administrative and Security Officer, Commander R.S. Brookings, USN,
Annexes E, F, G, H, I, L, and P

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OPERATION PLAN
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ANNEX C

TECHNICAL PLAN

I. General

To direct the general details of the work involved in carrying out the technical scientific mission of the Task Group, CDR E.S. Gilfillian, Jr., USNR, was designated by the Chief of Naval Operations as Technical Director of the Bikini Scientific Resurvey.

II. The Scientific groups listed hereinafter, and participating in the expedition, shall report to the Project Officer in accordance with their orders. In order for the Technical Director to carry out his responsibilities, the Project Officer has directed that these groups report to the Technical Director on all matters directly affecting their scientific work. They will keep the Technical Director constantly informed of their plans and progress, and of any unusual or unexpected fact or circumstance that may come under their observation; and submit to the Technical Director in writing such interim report as he may request. Individuals or groups will submit final reports direct to the Chief of the Armed Forces Special Weapons Project. The Technical Director will make available to the Technical Reports Officer all data which he receives with the exception of data that permit accurate calculation of the weight, composition, efficiency, or mechanism of the atomic bombs used at Bikini.

In order to insure maximum results from this expedition it is essential that different scientists and Department Heads participating exchange observations and ideas, fully and freely, up to the point where such exchange would make possible accurate calculation of the weight, composition, efficiency, or mechanism of the atomic bombs used at Bikini. The broad program of investigation has been planned very largely as an integrated and closely interrelated series of observations. The details of this program, however, can only be determined by discussions on the spot between the different groups of scientists, based on what they actually find at Bikini from day to day.

Scientific groups are as follows:

A. A group of biologists from the University of Washington, under the leadership of Dr. L.R. Donaldson, will measure the radioactive concentration in, and morphological and other effects upon fish, marine invertebrates and marine plants of the atoll reefs, and such other effects of the atomic bombs, or problems of scientific interest that they feel qualified to undertake.

B. A group of fisheries biologists and two (2) zoologists from the Fish and Wildlife Service of the Department of the Interior and the National Museum will study possible changes in populations of lagoon, reef and

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pelagic fishes, morphology of pelagic fish larvae, and such other effects of the atomic bombs, or problems of scientific interest that they feel qualified to undertake.

C. A group of biologists and oceanographers from Stanford University and the Scripps Institution of Oceanography, under contract with the Navy Department, will study the basic physiological and oceanographic processes involved in the metabolism, reproduction and growth of reef and lagoon organisms, and such other effects of the atomic bombs or problems of scientific interest that they feel qualified to undertake.

D. A group of six (6) geologists from the U.S. Geological Survey and the Navy Department will study any possible effects of the radioactivity released by the atomic bombs on the corals and calcareous algae, and the geological characteristics of the atoll; and such other effects of the atomic bombs or problems of scientific interest that they feel qualified to undertake. One of the most important tasks to be undertaken by this group will be the collection and sampling of bottom cores from an area of several square miles around the target center, in an attempt to determine the processes involved in the accumulation of radioactivity by bottom sediments after Test Baker.

In addition, bottom dredging will be undertaken on the outer slopes of Bikini Atoll, and on the top of the sea mount northwest of Bikini, in order to recover samples of the sub-surface bottom materials. Lead-line soundings of the seaward margin of the reef will be attempted from a small boat on the windward side of the atoll, and underwater photographs of the reef margin and surge channels will be taken.

The geological group will be accompanied by technicians employed by the George E. Failing Supply Company, who will conduct an exploratory drilling operation on Bikini Island and the adjacent reef. It is contemplated that six (6) holes will be drilled, and that cores will be taken down to depths from 300 to 2,500 feet.

E. A representative of Bartol Research Foundation will measure the low intensity radioactivity remaining in the island soil, and in the air over the atoll; and the cosmic ray and radioactive background and such other effects of the atomic bombs, or problems of scientific interest he feels qualified to undertake.

F. A group representing the Clinton Laboratories and other laboratories of the Atomic Energy Commission will investigate the accumulation and distribution of fission products and alpha-emitting materials in the organisms, the soils, the sediments, and the reef limestones; and the processes involved in the distribution of this material; and such other effects of the atomic bombs, or problems of scientific interest they feel qualified to undertake.

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ANNEX D

SUNKEN SHIP INSPECTION PLAN

I. General

To direct the general details of the proposed work of carrying out inspection and analysis of the sunken ships in Bikini Lagoon, LCDR F.B. Ewing, USN, has been designated by the Project Officer as Director of Ship Material of the Bikini Scientific Resurvey.

II. The Director of Ship Material will make detailed observations of ships sunk as a result of Operation Crossroads, with special attention to Saratoga, Nagato, Gilliam and Apogon. Other vessels including Arkansas and Pilotfish will be inspected if time permits.

In addition to observation reports from divers, as many underwater photographs as practicable will be taken of these vessels. The latest underwater cameras and artificial lighting will be used. Where practicable, underwater television will be used to permit surface observation of sunken hulls by experienced personnel.

While inspecting Nagato, at the discretion of the Director of Ship Material, divers will attempt to retrieve four instruments, the exact locations of which are known: one (1) ionization gage, two (2) linear time pressure recorders, and one (1) diaphragm type damage gage. These instruments are watertight and believed to be in good condition and of considerable value to the Operation Crossroads report.

The observations will include a detailed structural inspection of the sunken vessels, in an effort to determine the exact cause of sinking. Further, the inspection will attempt to identify minor structural failures such as bent, warped, or ruptured plating and scantlings.

From information derived from photographs it is believed that a portion of LSM-60 has been located. If time permits, an attempt will be made by divers to locate this section and inspect it thoroughly for type of rupture, heat effects, and radioactivity. If practicable, an attempt will be made to raise this section for an inspection on the surface.

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ANNEX E

ELECTRONICS PLAN

I. The Electronics Coordinating Officer is charged with the following responsibilities:

A. The procurement, installation, maintenance, and repair of all special communication equipment under the cognizance of the Project Officer.

B. The installation, maintenance and repair of special electronic devices, used in scientific work under cognizance of, and as requested by the Technical Director.

C. Assistance in installation, maintenance, and repair of television and diver voice-circuits under cognizance of the Director of Ship Material.

D. The installation, maintenance, repair and operation of the Task Group radio broadcasting facilities.

E. In emergencies, to provide assistance to electronics personnel of the vessels included in the Task Group.

F. To provide technical assistance on any problem involving electronics that may arise.

ANNEX F

COMMUNICATION PLAN

I. Bikini Scientific Resurvey communications will be in accordance with PAC 70(B) corrected through change No. 9. See Annex H for special non-local communication restrictions.

II. The attention of all officers and communication personnel is invited to the following:

A. 2,716 kc is employed for short-distance communications, and also as a port frequency for local communications when required. In general, 2,716 kc will be used between the guard ship (Chilton (APA-38)) and all power boats cruising beyond a ten-mile radius of the guard ship, using either voice or CW communications, whichever may be applicable. Power boats cruising within a ten-mile radius of the guard ship will use SCR-610 transceivers channel A on 32.8 mc, and emergency channel B on 36.5 mc. The island camp also will be equipped with appropriate communication gear and shall be included in the

power-boat net. A directive establishing net frequencies, call signs, and circuit discipline shall be published separately at a later date.

B. Transmission of messages of a higher security classification than Restricted over any voice circuit in this Task Group is prohibited. Inter-ship messages of higher classification shall be sent encrypted by radio, visual, guard-mail, or messenger.

C. The International Distress Frequency of 500 kc will be continually guarded by Chilton (APA-38) in accordance with existing communication instructions.

D. While underway in company, or in company Bikini area, Chilton (APA-38) shall take radio guard for all ships-in-company; i.e., 500 kc distress frequency, FOX schedule, 4,105 kc series ship-shore, and any other special circuits that may arise incident to resurvey operations.

E. All traffic addressed to agencies outside the Resurvey area originating on either Coucal (ASR-8) or LCI(L)-615, while in company with the Flagship, Chilton (APA-38), shall be relayed via the Flagship.

F. Intra-ship communications while underway will be by visual communications or TBS on 72.1 mc.

G. The following special call signs have been established for this operation:

COMMANDER TASK GROUP 10.12 (CTG 10.12)-M102
PROJECT OFFICER, BIKINI SCIENTIFIC
RESURVEY----------HAVS

ANNEX G

TECHNICAL LOGISTICS PLAN

I. Supply and Technical Personnel

A. Responsibility for initial supply

1. As directed by CNO Restricted letter, serial 176P36 of 2 June 1947, arrangements for supply of special equipment, and for the assignment of scientific and technical personnel, will be made by the Bureau of Ships in cooperation with other Offices and Bureaus.

2. The War Department has been requested by the Joint Chiefs of Staff to cooperate with the Navy in this resurvey of Bikini, and to furnish facilities and personnel as may be needed and can be made available.

3. Participating individuals and agencies have been requested to provide their own special equipment and materials wherever practicable and appropriate.

II. Initial Supplies and Equipment

A. Shore-based units: all shore-based units upon embarkation will be accompanied by:

1. Individual equipment

2. Housekeeping equipment

3. Organization equipment

4. Maintenance supplies for forty-five (45) days

B. Individuals: Each officer and civilian scientist of the project will be issued a quantity of clothing for use in the field and while on special projects.

C. Construction material: All material necessary for shore-based projects will be carried in units of the Task Group.

D. Estimated strength of land-based units requiring support:

1. Geological unit: 1 CB detachment; 2 officers and 30 men

2. Drilling Team: 8 men

3. Geological experts: 4 to 6 men

III. Transportation

A. All necessary supplies and equipment will be moved to the Bikini area in the initial movement insofar as possible.

B. Courier plane service by one (1) PBY is to be maintained by FleetAirWing between Kwajalein and Bikini for the purpose of carrying personnel, mail, and special freight for the project.

C. Boat Pools: A boat pool under control of the Boat Officer of Chilton (APA-38) will be maintained for ship-to-ship, ship-to-shore and specialized operations of the project requiring boat service, in accordance with Annex M.

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IV. Medical

A. All technical medical matters coming under the cognizance of the Project Officer are detailed in the Radiological Safety and Health Plan (Annex J).

V. Construction: Construction on Bikini will be limited to that required for:

A. CB detachment

B. The drilling group

C. The geological resurvey

D. Recreational facilities

E. Other special projects authorized by the Project Officer

VI. Miscellaneous

A. Mail: The mail address for all personnel connected with the project is:

Bikini Scientific Resurvey,
USS
c/o Fleet Post Office
San Francisco, California.

ANNEX H

SECURITY PLAN

I. General

A. Pertinent Security Regulations

1. U. S. Navy Regulations, Article 76

2. Army Regulations, 380-5 (Safeguarding Military Information)

3. U. S. Navy General Order No. 179 (Photographs of Naval Subjects)

4. Joint Chiefs of Staff 1552/78, of 21 Nov. 1946 (Security Directive concerning results of Atomic Bomb Tests)

5. Atomic Energy Act of 1946, Section 10 (b)

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B. Security Officer

The Administrative Officer of the Bikini Scientific Resurvey, CDR R.S. Brookings, USN, is designated as the Security Officer. It will be his duty to assure himself of the adequacy of compliance with all regulations listed above and herein set forth. He shall make constant effort to impress and indoctrinate all members of the project, military and civilian, with the gravity of their individual responsibility in maintaining security of classified information relating to Operation Crossroads and the present resurvey.

II. Clearance

All personnel, military or civilian, who will have access to restricted material as defined by the Atomic Energy Act, shall be cleared in accordance with provisions of Public Law 585 (Atomic Energy Act).

III. Overall Security

JCS paper 1552/78, approved 21 Nov. 1946, is quoted below as an especially applicable security directive:

"A. Bomb: Top Secret: Exact methods of placing and exploding the bomb, including the details of any special devices used, shall be classified Top Secret. Attention is directed to the necessity of ensuring by all measures the Top Secret security of information of the bomb itself, in accordance with current directives of the Officer-in-Charge of the Atomic Bomb Project and with the provisions of the Atomic Energy Act 1946."

"B. Locations: Top Secret: The precise location of the points of burst of the bomb with reference to any other point, including target ships. Secret: Precise distance relationships between vessels of the target fleet. Approximate distance relationships between bomb detonation points and other locations within a limit of accuracy of one hundred yards. Confidential: Planned precise locations of vessels of the target fleet."

"C. Radiation: Top Secret: All precise radiation intensity time-distance relationship records where they are correlated. Restricted: Any expressions of radiation intensities unrelated to time or distance. The existence of alpha radiation. Unclassified: The existence of beta or gamma radiation; qualitative expression of the existence of radiation; i.e., heavy, light, or absent."

"D. Radiological Decontamination: Secret: Detailed and precise scientific data on this subject. Compiled general data on results proceeding from the use of multiple processes. Restricted: All routine chemical and mechanical processes; information necessary for individual protection."

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"E. Scientific Observations and Measurements:

Top Secret:

1. Technical information obtained by instrumentation and minute inspection, such as the relationship between exact distances and pressures, structural strength, details of damage, effects of shock, and radioactivity.

2. Exact and detailed methods of measuring results. Secret: detailed information obtained from, and methods of making assessments of fission products and alpha hazards in target and operational vessels. Confidential: All other technical and scientific information pertaining to the results of Tests A and B: planned methods for measuring results."

"F. Ship Damage Reports: Top Secret: Final overall summary report by the Director of Ship Material. Secret: Complete consolidated technical reports by groups operating under the Director of Ship Material, except for such information as may be required to be classified Top Secret by preceding paragraphs in this memorandum. Confidential: Complete technical reports on any single ship provided they do not include material otherwise required to be Top Secret or Secret. Restricted: Individual ship form reports covering damage to ship components or groups of ship components such as pumps and piping, but not covering damage to the whole ship. Declassified: Any qualitative information on topside damage to ships. General information (i.e., "heavy damage", "light damage", "undamaged") on below-decks damage to ships."

IV. Photographic Security

All photographs dealing with underwater damage or classified material shall be processed through a Composite Panel appointed by the Project Officer for Photographic review, or forwarded to AFSWP for processing and review.

Personal photography will be subject at all times to the restrictions normally applicable to such photographs on Navy ships and in the vicinity of Army Installations.

V. Security of Instrument and Damage Data

Instruments shall be classified in accordance with the policy of the Bureau which provides them.

Group Leaders or Officers-in-Charge of any units engaged in the resurvey will be responsible for the security of the data or damage information obtained, and will carry out orders regarding physical security of the instruments in accordance with provisions of this plan.

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VI. Safety and Health Precautions

Detailed scientific data bearing specifically on safety and health shall be classified Top Secret.

Specific instructions to personnel exposed to particular hazards will be Restricted.

VII. Communications

All radio traffic pertaining to classified scientific or technical matters shall be so worded or phrased that it can be classified Restricted. All matter classified Confidential and Secret shall go by mail. Top Secret material shall be sent only by officer courier.

VIII. Miscellaneous

Laboratory areas of units engaged in the resurvey shall be restricted to authorized personnel.

Samples on which reports are based shall be classified the same as the report.

IX. Upon termination of his duty with the Bikini Scientific Resurvey, each participant will be guided as to what he may discuss by the Army and Navy regulations, and the Atomic Energy Act of 1946.

ANNEX I

PHOTOGRAPHY PLAN

I. Still and motion-picture surface photography will be conducted as required on Bikini Atoll. The photographic unit will be composed of a Photographic Officer and photographer's mates. Its purpose is to provide photographic facilities to assist the Project Officer in carrying out his mission. This unit will operate from Chilton (APA-38) where laboratory processing facilities have been established.

II. A photographer's mate will be assigned upon request to any group operating in the field and desiring photographic records. Details of subjects to be photographed will be furnished by each requesting agency at the time that the photographs are taken. This is for the purpose of insuring complete identification of all films for the record.

III. All black-and-white still photographs will be developed and printed on board Chilton (APA-38). All motion picture and still color film will be forwarded to the Naval Photographic Center, Naval Air Station, Washington, D.C., for processing. Films developed on Chilton (APA-38) will be retained on board until such time as the Project Officer may direct that they be forwarded to the

Naval Photographic Center. Two master file prints will be made from all film developed on Chilton (APA-38), one of which will be forwarded immediately with full identification to the Naval Photographic Center.

IV. A block of numbers from 5,000 to 6,499 inclusive has been assigned for filing film exposed on this expedition. Insofar as possible, 4x5 inch packs containing 12 pieces of film will be used. Each film pack will be numbered serially from the assigned block of numbers. The numbers will be affixed to the film pack in such a manner that they will record on each piece of film at the time of exposure. In addition, each of the 12 pieces of film will be numbered (1 to 12). For example, the number 5,201-6 would indicate exposure 6 of film pack 5,201. All other cut film will be numbered in a similar manner. Motion picture film will be identified by photographing a slate prior to actually taking a scene.

V. Each photographer's mate will record all pertinent data concerning each subject at the time it is actually photographed. This data will be transferred to a log (maintained on board Chilton (APA-38)) of all film exposed. The log will show the permanent file number of the film, and all other useful information.

ANNEX J

RADIOLOGICAL SAFETY AND HEALTH PLAN

I. Organization

A. Radiological Health Section

1. Evaluation of radiological hazards and recommendations for safety procedures

2. Photographic dosimetry

B. Radiological Safety Section

1. Monitoring operations

2. Decontamination "change stations"

C. Radiological Health Advisory Board

1. This Board will consist of the Radiological Health and Safety Officers and such scientific personnel as may be appointed by the Project Officer of the resurvey. It will advise, evaluate, and make recommendations in writing to the Radiological Health Officer in special radiological health matters not covered in BuMed directives; i.e., radiological clearance of questionable areas.

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II. Staff

A. Radiological Health Officer

CDR. H.S. Etter (MC), USN

B. Radiological Safety Officer

LTCOL C.E. Grant, (CML.C), USA

C. Radiological Health Advisory Board

CDR H.S. Etter
LTCOL C.E. Grant
Dr. F.H. Rodenbaugh (M.D.)
Dr. J.H. Roberson

III. Mission

The mission of the Radiological Health and Safety organization will be to protect personnel from radiological health hazards which may be encountered in the Bikini Scientific Resurvey operations.

IV. Tasks

A. The Radiological Health Officer and the Radiological Safety Officer will prepare the Health and Safety Plans to be followed in this operation, and will be responsible for the execution of radiological health and safety directives. They will organize and direct all medical and technical elements of the operation required to execute this plan.

B. The Radiological Health and Radiological Safety Plans are attached hereto as Appendixes I and II, respectively.

ANNEX J: APPENDIX I

RADIOLOGICAL HEALTH PLAN

I. Recognized Radiological Hazards

A. Two types of radiological hazards are recognized: "External radiation", and "internal radiation". The former is the type received when standing in the path of a powerful X-Ray beam. The latter produces an effect similar to that resulting from the ingestion of radium or the inhalation of radioactive dust.

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B. Because of the natural radioactive decay which has taken place since Test A and Test B, the "external radiation" hazard is of lesser importance, but in some localities may prove to be dangerous.

C. The "internal radiation" hazard, however, may still be important. It is characterized by the fact that the injurious material produces damage only when it gains access to the body through ingestion, inhalation, or through breaks in the skin. It may best be visualized on the one hand as comparable to the hazard present in the mining of radioactive materials (inhalation), and on the other to that encountered in the painting of radium dials (ingestion). Even in cases of extreme exposure, characteristic clinical findings may not appear for several years. Even when the exposure is not sufficient to cause death, it may produce tumors in various tissues.

II. Estimate of Current Radiological Hazards

A. General Information

1. The detonation of an atomic bomb liberates an enormous quantity of electromagnetic radiations and neutrons. The electromagnetic radiations include infra-red, visible light, ultra-violet light, X-Rays, and gamma radiation.

2. Thereafter, the products formed during the fission process emit gamma rays and beta particles, constituting the "external radiation" hazard.

3. The bomb also releases other products that constitute an "internal radiation" hazard.

B. Present hazards as a result of Test A (air blast)

1. None

C. Present hazards as a result of Test B (underwater blast)

1. In an underwater burst such as Test B, the radiation resulting from residual radioactive products still may be of considerable magnitude.

2. The products of fission sometimes are absorbed and concentrated in and on ships, corals, algae, and animals. At the present time, radiation hazards of this sort seem remote.

3. However, the highly dangerous unfissioned material producing alpha radiation has a half-life of several thousand years, and will be practically undiminished in intensity due to decay. It was more or less concentrated immediately following Test B, but probably will now be more widely distributed within the atoll area.

4. These unfissioned alpha-emitters, together with the fissioned beta and gamma-radiating products, will occur in greatest concentrations in the area of the coral crater produced by the underwater blast.

5. The sunken ships in this area can be considered contaminated to a relatively high degree, and other areas throughout the lagoon will be considered dangerous until radiologically cleared.

6. Algae, fish and other marine organisms may contain relatively high concentrations of both fissioned and unfissioned materials.

III. Personnel Pre-Examination

A. All personnel, both military and civilian, who are to participate in the Bikini Scientific Resurvey will be required to have a special physical examination prior to entering upon such duty.

B. Special medical records, separate from the individual's health records, will be set up under the cognizance of the Radiological Health Officer, and will be classified Confidential.

C. Particular attention will be given to a history of skin sensitivity and respiratory allergy, and it will be necessary to eliminate from contact with radioactive materials personnel who have chronic infections or chronic conditions of any nature, particularly skin or respiratory infections, blood dyscrasias, extensive fungus infections of the skin and scalp, pre-cancerous lesions, and all open wounds on the hands.

D. The clinical laboratory examination will include, in addition to a complete blood count, an erythrocyte sedimentation rate, an X-Ray of the chest, and a complete urinalysis. Beta counts will be made on the urine when indicated, and if necessary, more extensive radiochemical analysis will be completed. The X-Ray of the chest is considered important for future reference, and will be made on full-aixed film and filed in the "special medical record".

E. These examinations must be completed before personnel will be given medical clearance to engage in the Bikini Scientific Resurvey.

IV. Personnel Follow-Up Examinations

A. All personnel will be given a follow-up medical examination upon completion of the Bikini Scientific Resurvey, even though it is unlikely that any evidence of overexposure will be encountered if safety regulations are followed.

B. Particular attention will be given to the hands for any signs of radiation effects, such as reddening of the skin around the nails or changes in the finger prints. These observations will be used as a screening method to select those who should be referred to a Medical Advisory Board for more careful evaluation.

C. The urine will be carefully studied in case of accidental overexposure to radiation or radioactive materials. Beta counts will be made, and if twice background or higher is found in any urine sample, more extensive radiological tests will be carried out.

D. The follow-up examination will include complete blood counts, and an erythrocyte sedimentation rate. All blood samples should be obtained under similar technique, and at the same time of day for each individual. Since a variety of changes is possible in the blood picture after exposure to radiation, all blood counts will require interpretation by a medical officer trained in the special problems of hematology in radiation sickness. In cases suspected of overexposure, or when unexplained laboratory findings occur, total erythrocyte and leucocyte counts will be made, and urine beta counts repeated. Individuals presenting these findings, and individuals known to have received overexposure to external radiation, as shown by photographic dosimetry, will be eliminated from further possible exposure pending the outcome of these studies.

V. Personnel Protection

A. General Information

1. All personnel will be issued protective clothing consisting of caps, green work pants and shirts, canvas gloves, and work shoes.

2. This uniform will be worn by all personnel working at tasks or in areas considered dangerously radiologically contaminated.

3. The wearing of protective clothing and the use of other designated protective measures must be rigidly followed until the radiological situation has been evaluated by the Radiological Safety and Health Sections.

4. Navy Gas Masks with B-2 canisters will be made available for use in situations where radioactive dust is found present in hazardous amounts.

5. The Radiological Health Officer will make recommendations as to changes in safety regulations as the situation may require.

B. Beach Working-Parties

1. Initial beach working-parties will be accompanied or preceded by a Radiological Safety Officer, and all members of each party will wear the prescribed protective clothing.

2. The Radiological Safety Officer will determine if any contamination exists, and will collect suitable samples of materials for laboratory examination aboard ship.

3. Great care shall be taken to avoid eating or eating with, drinking or drinking with, any materials found on the islands until radiological clearance has been given. In most cases this clearance will require shipboard laboratory tests of the materials in question. (There shall be no swimming in lagoon waters until clearance has been given by the Radiological Health Officer.)

C. Scientific Expeditions to Beaches and Reefs

1. A Radiological Safety Officer will accompany all initial expeditions to reefs and beaches.

2. All protective measures will be executed until the radiological situation has been fully determined and clearance given by Radiological Health Officer.

3. Care must be exercised to avoid cuts and scratches from sharp coral, as open wounds are extremely hazardous when handling materials contaminated with radioactive fission products and unfissioned materials. If any such wounds occur accidentally, the Radiological Health Officer will be notified immediately.

D. Camps Ashore

1. All new camp sites and existing camps, buildings, and other materials, which may be utilized as a shore-based camp for living purposes, will be checked by monitors before use, and laboratory analyses of samples will be made, when and if indicated.

2. Particular attention will be given to drinking water in tanks and service pipes. Water analysis will be made before such facilities are rehabilitated for use.

3. All gear that is found on Bikini Island associated with the preparation of, and handling of food and drink, must be thoroughly scrubbed cleaned, and radiologically cleared before being returned to such service.

4. Rusty or corroded materials must not be allowed to come in contact with food or drink.

5. The north end of Bikini Island was the most heavily contaminated, and special precautions must be taken if camp sites are required in this area. Under no circumstances will marine life of any type (found within or about the atoll) be eaten, unless prior radiological health clearance has been given.

E. Diving Operations

1. The deep-water diving operations for the inspection of the sunken target ships probably will constitute the greatest radiological hazard to Resurvey personnel. Most of these operations will be within or about the coral crater formed by the underwater blast. The coral and sediment, as well as the ships in this sector, were highly radioactive following Test B of last year. Allowing for natural decay, there still will be considerable radiation present, together with hazardous quantities of fissioned and unfissioned material.

2. All protective measures will be adhered to by personnel engaged and assisting in those operations.

3. Radiological Safety Officers will determine the extent of the radiation, and safe working period with deep-water survey probes, at the site and prior to the diver's descent.

4. All diving clothing, gear, and associated equipment which has been submerged will be washed off with a stream of water as it is hoisted; carefully monitored; and further decontaminated if necessary.

5. Divers will be monitored, and will proceed through the "change station", if necessary, for decontamination prior to being remonitored. If any part of the body exceeds twice background count, showering or scrubbing with soap and water must be repeated until this level has been attained.

6. All personnel handling diving gear and associated equipment that comes in contact with radioactive materials will be processed in the same manner as divers.

7. While it is anticipated that radiological hazards in connection with shallow-water diving along atoll reefs will be minor, all diving areas will be initially checked by monitors with underwater probes, and laboratory samples will be taken for analysis if necessary. Based upon the monitoring reports and laboratory findings, the Radiological Health Officer will determine the protective measures necessary.

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OPERATION PLAN
ComBikResurvGroup No. 1-47

VI. Protective Procedures and Equipment

A. Monitoring instruments

1. For general field and personnel monitoring, the type 263 Geiger tube survey meter will be used. This instrument can detect both beta and gamma radiation in a range from less than 0.001 r/24 hr. In addition, by use of ear phones, background counts can be determined.

2. For alpha detection in the field, the portable "Zeuto" nylon window ionization chamber will be used. Since this instrument requires the presence of considerable alpha activity in order to respond a negative indication does not signify complete absence of alpha-emitters. Laboratory analysis of suspected samples will be required.

3. For gamma radiation measurements in the vicinity of sunken ships and bomb crater coral, the Type 235 survey meter with an ionization chamber in an extended probe will be used. This instrument has a gamma range of from 0.001 r/24 hr. to 0.6 r/24 hr, but will not detect the presence of alpha or beta radiation.

4. For supplementing film badges, the pencil type quartz fiber dosimeter will be used. This pocket type instrument depends upon the ionizing discharge of a quartz fiber within its ionization chamber, and is a dectector of gamma radiation. It has a range from 0 to 2.0 r. Pencil dosimeters will be worn by all deep-water divers and by others as conditions indicate.

B. Photographic dosimetry

1. A photographic dosimetry unit will be set up to issue, receive, and process film badges. The Radiological Health Officer will have cognizance of this unit. The Type K film badges used will totalize the amount of general body radiation received. They have a gamma range from 0 to 2.0 r.

2. Film badges will be worn by all deep-water divers, and all others contacting significant radiation, and will be processed daily for divers, and for others at intervals dictated by the radiation contacted.

3. Complete records will be kept of name, badge numbers, date, and hours of exposure. The exposure will be totalized for each individual concerned, and entered into the total dosage record for the operation.

4. As a general rule, an individual will be permitted to re-engage in the same operation the following day only if the tolerance limit of total body radiation of 0.1 r per day has not been exceeded.

C. Decontamination "Change Stations"

1. Personnel decontamination or "change stations" will be established aboard Chilton (APA-38), Coucal (ASR-8), and on LCI (L)-615, if necessary.

2. All personnel returning to these ships who have been engaged in operations resulting in contamination to clothing or body will proceed through the "change station".

3. A special compartment will be provided for the removal of contaminated clothing; handwashing facilities, including brushes for scrubbing the nails, will be provided separate from the showers.

4. After gross dirt and contamination are removed from the hands by repeated scrubbing with soap and water, personnel will proceed to the shower and wash the body, repeatedly soaping and rinsing. They will then dry themselves in the shower room, and re-enter the non-contaminated dressing room, where they will be completely monitored, with special attention being given to the hair, hands and feet. A Type 263 survey meter with ear phones shall be used for personnel monitoring.

5. If any part of the body reads above twice background count, a second scrubbing and shower must be taken, and the decontamination process repeated until this level is attained, prior to donning clean clothing.

6. Contaminated clothing will be laundered in a special portable laundry which will be used exclusively for such purposes. The waste water from the portable laundry equipment will be pumped over the side and not connected to the ship's sanitary system. Monitors will inspect the laundry equipment from time to time to make sure that it is not accumulating any contamination. Clothing that exceeds twice background gamma plus beta, after repeated laundering, will be discarded and disposed of in a safe manner.

D. Radiological Sample Handling and Storage

1. Care will be exercised in handling and storing radioactive samples to prevent the spilling and spreading of contaminated material about the ship.

2. All samples must be placed in covered bottles or jars wherever practicable before being brought aboard ship, and well-packaged or placed in leakproof containers, in such manner that no wet or dry material can escape.

3. Special storage spaces will be designated and properly marked for the storage of "hot" samples. These spaces shall be so-located that no personnel can receive more than 0.1 r/24 hr. radiation from them.

4. Shelves in sample rooms shall be lined with paper or other suitable disposable material, to protect against or pick up any accidental spills.

5. Scientific laboratory work tables used for contaminated material likewise shall be covered with disposable paper, to prevent the accumulation of radioactive materials. This is important both as a health measure and as an aid in keeping laboratory background counts low.

6. Suitable, well-marked disposal cans shall be provided in sample sorting rooms and technical laboratories for the disposal of discarded radioactive specimens and wastes. No radioactive wastes will be discarded in the ship's sanitary system, since radioactivity will accumulate and may later present a difficult decontamination problem.

7. Monitors will be assigned to make periodic inspections of sample rooms and technical laboratories.

ANNEX J: APPENDIX II

RADIOLOGICAL SAFETY PLAN

I. Organization

Chief of Section - Lieutenant Colonel C.E. Grant, (Cml.C.), and Radiological Safety Officers.

The Radiological Safety Section will be based aboard Chilton (APA-38).

II. General Information

Appendix I to this Annex contains general information relative to the radiological situation expected to be encountered by personnel engaged in the operations to be undertaken by the Bikini Scientific Resurvey.

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OPERATION PLAN
ComBikResurvGroup No. 1-47

III. Mission

To determine the magnitude of the radiological hazards existing within the operational area, and to furnish the Radiological Health Officer with such data and reports as may be required to permit an accurate evaluation of the radiological situation, and the formulation of policies and procedure necessary for the protection of personnel engaged in the operation.

IV. Tasks

A. Monitoring Operations

1. Preliminary Survey of Bikini Island

Radiological Safety Officers will accompany the initial parties ashore on Bikini Island, and will begin a preliminary radiological survey thereof. This preliminary survey will be completed as soon as practicable, and particular emphasis will be placed upon the monitoring of all existent buildings or structures on the island.

2. Diving Operations

a. Deep Water

Two (2) Radiological Safety Officers will be aboard Coucal (ASR-8) during all deep water diving operations conducted from that vessel. One (1) Radiological Safety Officer will operate the deep-water probe during such operations, and one (1) Radiological Safety Officer will be responsible for the monitoring of all divers returning aboard Coucal (ASR-8), together with the monitoring of all samples brought to the surface by the divers.

Detailed instructions as to precautionary measures to be taken in connection with deep-water diving are contained in paragraph V(E) of Appendix I to this Annex.

3. Core Sampling

One (1) Radiological Safety Officer will be aboard LCI (L)-615 during all core-sampling operations conducted from that ship. The Radiological Safety Officer will be responsible for the monitoring of all samples and personnel engaged in the work on the vessel.

4. Accompaniment of Beach and Boat Parties

Radiological Safety Officers will accompany all beach and boat parties working within the operational area until such time as specific localities have been determined to be free from radiation hazards and properly cleared by the Radiological Health Officer.

5. Periodic Inspections

Radiological Safety Officers will periodically check various parts of their ships for radioactivity. Such checks will include condensers, evaporators, fire mains, flushing systems, etc., where there may be a concentration or deposition of radioactive materials from contaminated water.

6. Special Radiological Reconnaissance

Special radiological reconnaissance, not essential to safety, may be conducted by the Radiological Safety Section when safety requirements are not over-riding.

V. Protection of Personnel

A. Film Badges

Radiological Safety Officers will issue film badges daily to individuals entering hazardous areas, and will collect these badges at the end of each day for delivery to the Photographic Dosimetry Unit. This procedure will be followed until such time as radiological reconnaissance indicates that it may be modified in specific instances. All exceptions to this procedure will be cleared and announced by the Radiological Health Officer.

B. Protective Clothing

1. General

Radiological Safety Officers will insure that members of all scientific work parties are equipped with the following items of protective clothing:

Cap, "baseball type"
Shirt, working, green twill
Trousers, working, green twill
Shoes, field
Gloves, canvas (Will be issued whenever radiological conditions warrant.)

C. Clothing for Divers

Personnel engaged in shallow-diving operations in areas presenting a radiological hazard will be provided with the following items of protective equipment in addition to their normal diving gear:

Gloves, canvas
Coveralls

D. Decontamination

1. Decontamination or "change stations" will be established aboard Chilton (APA-38), Coucal (ASR-8), and LCI(L)-615, if required.

2. Radiological Safety Officers will monitor all personnel upon the completion of personal decontamination procedures, and each individual will be responsible for reporting to the Radiological Safety Officer in attendance for such monitoring prior to donning his clean clothing.

3. Detailed instructions as to the decontamination procedures to be followed is contained in paragraph VI(C) of Appendix I to this Annex.

E. Technical Reports and Data

1. The Radiological Safety Section will receive and maintain files of monitoring reports compiled during the operation, will maintain the "radiological situation map", and will compile such additional data as may be required by the Project Officer, Bikini Scientific Resurvey.

2. The Radiological Safety Officer will cooperate with the Radiological Health Officer, and will submit all data pertaining to the existent radiological situation to him for review and evaluation.

ANNEX K

RE-ENTRY PLAN

I. Mission

The mission of the Re-Entry Plan is to prescribe the procedures and landing operations to be followed in re-entering Bikini Lagoon, and to establish the necessary priorities for the off-loading of such cargo from Chilton (APA-38) as may be required for the initiation and support of shore-based operations on Bikini Island immediately following the arrival of the Task Group at Bikini Atoll.

II. General Information

A. Estimated time of arrival at Bikini is 0800 hours, 15 July. The following plan is predicated upon this ETA, and must be modified to conform to any significant deviation in arrival time which may occur.

B. Operations to be conducted under the provisions of this plan will include:

1. Dispatch of an advance landing and reconnaissance party to Bikini Island.

2. Radiological reconnaissance of Bikini Island and such other areas as may be occupied during the initial phases of the resurvey operation.
3. Off-loading from Chilton (APA-38) of cargo required for the initiation and support of the drilling operations on Bikini Island.

C. Chilton (APA-38) cargo destined for off-loading at Bikini consists of vehicles, drilling equipment, camp gear, and approximately 240 tons of lumber for construction.

D. All cargo unloading operations will be carried out during daylight hours.

III. Tasks

A. Program for 15 July

1. Arrive Bikini Atoll at 0800 hours.
2. Launch LCVP to carry Project Officer's advance landing and reconnaissance party to Bikini Island as Chilton (APA-38) enters ENYU Channel.
3. Conduct radiological reconnaissance of Bikini Island, and such other areas as may be designated. Monitoring procedures will be carried out in accordance with the provisions of the Radiological Safety and Health Plan (Annex J).
4. Conduct reconnaissance of Bikini Island for the purpose of establishing suitable beach unloading points, camp and supply dump sites, and drill sites.
5. Fuel and check operating condition, preparatory to unloading, of all vehicles, consistent with the ship's fire and safety regulations.
6. Launch small boats and clear decks and hatches preparatory to discharging cargo.
7. Start unloading as soon as radiological clearance of Bikini Island is obtained from radiological reconnaissance party as follows: with two (2) LCM's, unload CB equipment (bulldozers, drill rig and casings, truck crane, trucks, supplies, etc., from No. 3 Hold.)

B. Program for 16 July

1. Upon completing the off-loading of the CB heavy equipment, one (1) LCM will be assigned to the Director of Ship Material for use in unloading the diving gear from Chilton (APA-38) and for subsequent and continued use by the Director of Ship Material in shallow-water diving operations.

2. Unload bottom sampling and underwater photographic equipment from No. 5 Hold, and transfer to the LCI(L)-615.

3. Commence unloading CB camp gear, supplies, and equipment from the No. 3 Hold, using one (1) LCM and LCVP's as required.

4. Unload initial maintenance stocks of gasoline, diesel oil, lubricants, etc., together with necessary dispensing equipment.

5. Continue to unload, on call from the Construction Officer, such CB camp equipment as may be required for establishing the base ashore.

C. Program for 17 July

1. Using one (1) LCM and LCVP's as required, complete the unloading of CB camp gear and equipment.

2. Upon call from the Construction Officer, begin the off-loading of lumber from No. 5 Hold.

D. Program for 19-22 July

1. Using one (1) LCM and LCVP's as required, unload lumber from No. 5 Hold as required and called for by the Construction Officer.

IV. Priority Lists of Material to be Off-Loaded

A. Detailed priority lists governing the supplies and equipment to be unloaded from the Chilton (APA-38) during the initial phases of the operation are attached hereto as Appendix I.

V. Personnel for Beach Party

A. The X-Ray Division Officer will make available to the Construction Officer upon call, a twenty (20) man work detail to assist in the unloading and distribution of material on the beach at Bikini Island. It is anticipated that this detail will be required upon the commencement of the off-loading of the CB camp gear, continuing daily through the unloading and stacking ashore of such lumber as may be required for shore-based operations.

ANNEX K: APPENDIX I

PRIORITIES FOR CARGO DISCHARGE

DISCHARGE PRIORITY	ITEM	LOCATION ABOARD CHILTON (APA-38)
1	Bulldozer	No. 3 Hold
2	Bulldozer	No. 3 Hold
3	Drill rig	No. 3 Hold
4	Truck and Boom crane	No. 3 Hold
5	* Truck, Cargo, 6x6	No. 3 Hold
6	Trailer, Fire Pump	No. 3 Hold
7	* Truck, Dump, 6x6	No. 3 Hold
8	Trailer, LVBE	No. 3 Hold
9	Pontoons	No. 3 Hold
10	Drill Casings	No. 3 Hold
11	* Truck, Dump, 6x6	No. 3 Hold
12	* Truck, Dump, 6x6	No. 3 Hold
13	* Truck, 3/4 Ton, 4x4	No. 3 Hold
14	Trailer, Fire pump	No. 3 Hold
15	Bottom sampling and underwater photographic equipment	No. 5 Hold
16	Motor fuels and lubricants	

*Trucks will carry fuel and lubricants sufficient for first day's operation ashore.

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ComBikResurvGroup No. 1-47

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ANNEX L

PUBLIC INFORMATION PLAN

I. Certain obvious features of the Bikini Scientific Resurvey must be considered in the formulation of a workable public information plan; these include:

A. High order of security. All aspects of the atomic bomb tests and their evaluation must be treated, from a public information standpoint, in accordance with security regulations established by the United States Atomic Energy Commission and the Armed Forces Special Weapons Project.

B. The relative ease of maintaining control of all information from Bikini. Representatives of the press, radio, and picture services (still and motion picture) will not accompany the resurvey group.

C. The low order of security connected with many aspects of the resurvey operation; i.e., personalities, human-interest stories, recreational activities, uses of non-classified equipment, etc.

D. The necessity for presenting to the American people, in an intelligent manner, the story of cooperation that exists between civilian and military agencies in the Bikini resurvey work. Proper handling of the Bikini resurvey story can do much to acquaint the American public with the long range value of Operation Crossroads.

E. The importance of providing a continuing series of newsworthy press releases to the public, through established public information channels during the course of the operation. These press summaries should begin immediately following the official public announcement of the resurvey. Interesting, newsworthy stories from Bikini, that concern the operation, will forestall much press criticism and speculation of a harmful nature. Despite the initial Restricted category of the resurvey operation, the Navy Department Press Section has received several queries from the press.

F. General Objectives: within the limits of security, to provide as full coverage as possible to all public information media, concerning the non-classified aspects of the scientific resurvey of Bikini Atoll. To meet this general objective the following Public Information Operational Plan will be followed:

1. Press Communications: The Project Officer, acting through and with the advice of the Project Security Officer, shall have the authority to release Press Summaries via the Naval Communications Service to the Director, Office of Public Information, Navy Department, Washington, D.C. Press Summary dispatches will be unclassified except in those cases where the Project Security Officer may direct that they be classified Restricted. Restricted Press Summaries will carry that classification until such time

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as they are released by the Director of Public Information, Navy Department. The responsibility for security clearance and release in accordance with existing regulations will rest with the Director of Public Information, Navy Department, Washington, D.C. Information copies of all Bikini Resurvey Press Summaries marked Hold For Release By Director of Public Information, Navy Department, will be addressed to the Public Information Officer, Commander-in-Chief, Pacific Fleet. Press Summaries for the scientific resurvey of Bikini Atoll operation prepared by the Public Information Officer (Liuetenant Commander W.R. Richardson) will in general deal with the following non-classified subjects:

a. Movements of ships comprising the Bikini resurvey group.

b. Personalities: news stories concerning civilian or military personnel. Many scientists with the expedition will be newsworthy personages, and as such can be the subject of interesting press releases.

c. Equipment and techniques: stories of diving operations, underwater photography, drilling, etc., that do not violate the security pattern established in the initial press release, or that do not violate the pattern established in the Operation Crossroads Security Annex.

d. Recreation: stories that concern the men, and how they spend their leisure time. Human interest stories on non-classified subjects.

e. Specimens: press releases concerning the collection of fish, clams, birds, and other living organisms in the Bikini area. Press summaries need not include evaluations of findings when those findings seem to violate existing security regulations.

f. Sunken ships: press releases that concern the location of ships by divers and such findings they may make, that do not violate the basic Operation Crossroads security pattern.

g. Science stories concerning the study to be made of the Bikini reefs, and the geological structure of atolls.

II. Still Photographs

Negatives and contact prints of all still photographs, which, in the opinion of the Public Information Officer, have news value, will be forwarded by earliest air courier service to the Naval Photographic Center, Washington, D.C., for review by the Operation Crossroads Security Review Panel. Each shipment of still photographs from Bikini will contain a memorandum from the Public Information Officer requesting (by film number) priority security review of certain of

the more newsworthy photographs. When and if such designated still photographs have been de-classified by the proper security authorities for public release, the Operation Crossroads Photographic Officer (Capt (Marine Corps) A. L. Bibee) will notify the Public Information Pictorial Officer, Navy Department (Commander John Levick). After such notification, the responsibility for actual release of the non-classified photographs will rest with that officer.

III. Motion Pictures

The Public Information Officer will make recommendations by memorandum to the Operation Crossroads Photographic Officer (Capt Bibee) concerning priority security review and processing of motion picture film forwarded from Bikini to the Naval Photographic Center, Washington, D.C. Such memoranda will accompany all shipments of motion picture film that are deemed to have potential public information value. After motion picture film from Bikini has been processed and screened for security, that footage which has been de-classified for possible release shall be made immediately available to the Motion Picture Section Public Information, Navy Department (Lieutenant Commander Winn) for action.

A. It is desirable that existing Army and/or Navy air courier services between Kwajalein and Washington, D.C., be made available to the Bikini Scientific Resurvey for shipments of classified film.

B. It is desirable that the Operation Crossroads Security Review Panel pass upon the security of all Public Information priority still photographs within three (3) days after their receipt at the Photographic Center. Similar arrangements for earliest possible security review of Bikini motion picture footage is desirable.

IV. Because the Scientific Resurvey of Bikini Atoll is a joint operation participated in by both Army and Navy personnel, all Press Releases from Bikini and still or motion picture releases should carry a joint Army-Navy credit line.

ANNEX M

BOAT POOL PLAN

I. A Bikini Boat Pool is hereby established under the direction and control of the Commanding Officer, Chilton (APA-38).

II. The mission of the Boat Pool is to provide, for the duration of the Bikini Scientific Resurvey, ship-to-ship, ship-to-shore, and other special boat operations that may be required in support of the project.

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III. Boating facilities assigned to the Bikini Boat Pool are as follows:

3 Picket Boats
6 PPB
8 LCPL
2 LCM
6 LCVP
1 DUKW
1 MWB
4 Wherries

IV. The Boat Pool will be under the direction of the Commanding Officer of <u>Chilton</u> (APA-38) through his Boat Control Officer who will perform the following functions:

A. Assignment of available craft and crews to such groups of the resurvey project as may be designated by the Project Officer.

B. Maintenance.

C. Safety precautions and regulations; promulgation and enforcement.

D. Indoctrination in operation and safety.

E. Schedules. Maintain such detailed schedules for guard mail, recreation, beach liaison, garbage disposal, etc., as may be necessary.

F. Salvage.

G. Retrievers. Maintain retrieving facilities to render assistance to boats in distress.

H. Communication. Radio communication with all boats away from the ship, except those on short intership trips or trips to Bikini Island, will be maintained continuously from a Central Boat Control Station in <u>Chilton</u> (APA-38). For more detailed boat communication instructions see Appendix I to this Annex.

I. Moorings. Provide as necessary for proper securing of boats when not in use.

J. Fueling. Stations to be located as follows:

Gasoline - on Bikini Island.
Diesel - alongside <u>Chilton</u> (APA-38).

V. The Project Officer will issue instructions to his Scientific Staff setting up a procedure for planning the allocation and coordination of available boats according to the needs of the various Scientific Groups, to the best interest of all concerned and of the project as a whole.

ANNEX M: APPENDIX I

BOAT COMMUNICATIONS

I. Each boat transporting working resurvey parties shall be equipped with a radio transmitter-receiver capable of voice communication. Each boat party will be required to make a departure and arrival movement report and also to make radio contact with the Guard Ship Chilton (APA-38) at least once each hour. Movement reports will include destination, time of departure, and estimated duration of trip. The hourly contacts will include time, and approximate position or distance and bearing from Guard Ship. The Chilton (APA-38) will control these radio nets. In the event that any boat has an emergency call in for assistance, all other boats on the net shall maintain strict radio silence until directed to break radio silence by the Guard Ship. If and when an emergency arises, all boats will stand by to go to the aid of the boat requiring assistance.

II. Any boat going beyond a ten-mile radius of the Guard Ship shall be accompanied by a qualified radioman or electronics technician's mate who will operate the radio equipment. Boats going beyond a ten-mile radius will be equipped with adequate radio equipment to cover the distance involved.

III. Any power boat departing from one island for another shall make a departure report immediately.

IV. The foregoing applies to all boats used for recreation purposes also, except for those plying between the Task Group and Bikini Island recreation areas.

ANNEX N

TECHNICAL REPORTS PLAN

I. General

To supervise preparation and editing of the Technical Report Lieutenant Commander F.L. Fitzpatrick, USNR, has been designated by the Project Officer as Technical Reports Officer of the Bikini Scientific Resurvey.

II. Progress and final reports of the Scientific Groups will be made available to the Technical Reports Officer by the Technical Director, as detailed in Annex C. Other information required for preparation of the Technical Report will be obtained by the Technical Reports Officer in conference with the Task Group

Commander, the Project Officer, the Technical Director, the Heads of Departments, and the leaders of Scientific Groups.

III. The Technical Reports Officer shall prepare the portions of the Technical Report which deal with the origin, authorization, mission, operations, and organization of the Bikini Scientific Resurvey. He shall edit and incorporate into the Technical Report the various reports of Scientific Groups and Heads of Departments.

ANNEX O

TYPHOON PLAN

I. Bikini is in the general area where typhoons are formed in the western North Pacific. Typhoons appear first in this region as areas of increased convective and heavy shower activity. Such disturbances move westward and northwestward as they intensify. Most typhoons which develop in the Marshalls move clear of them before achieving destructive force. These tropical storms are most frequent in July and August. Wind velocities over 40 kts are not expected from most of these storms until they are out of the Bikini area.

II. The Typhoon Plan will be executed upon the approach of bad weather of such intensity that normal operations will not be possible. Plans Able, Baker or Charlie will be designated, referring to the degree of bad weather expected. Plan Able will be designated when weather conditions make advisable the cessation of all routine boat operations. Plan Baker will be designated when weather conditions are such that there is danger of ships dragging anchor. Plan Charlie will be designated when winds of typhoon velocity are expected.

III. Upon execution of Typhoon Plan Able, the following specific measures shall be carried out:

A. Cease all routine boat operations.

B. All beached craft and beach-side equipment withdraw from the beach.

C. Hoist all small craft.

D. The Coucal (ASR-8) stand by to assist landing ships and craft, or other vessels in distress in accordance with orders of CTG 10.12.

E. Pontoon barges and causeways may be beached to prevent damage if such action appears advisable to the responsible officer.

F. Personnel ashore will remain there unless they can safely and quickly return to their ships (in which case they will do so), or unless ordered otherwise by CTG 10.12.

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IV. On execution of Typhoon Plan Baker, the following specific measures shall be carried out, in addition to those listed in paragraph III:

A. All ships take precautions to guard against dragging

B. All ships be prepared to get underway on 15-minute notice

C. Seaplanes take off and proceed to seaplane base, Kwajalein

V. On execution of Typhoon Plan Charlie, the following specific measures shall be carried out, in addition to those listed in paragraph III:

A. All ships be prepared to get underway immediately.

B. LCI(L)-615 and other small vessels of similar or smaller size, anchor within Bikini Atoll with maximum scope in best lee behind islands. Use engines as necessary to relieve strain on ground tackle.

C. Secure all non-propelled craft or disabled ships as well as possible; veering to maximum scope of chain, laying out additional anchors, and towing to better protected berths as practicable.

D. Ships at moorings (permanent type), which are safer there than at sea, may at the discretion of the Task Group Commander be left at moorings; otherwise go to sea.

E. Coucal (ASR-8) remain in lagoon as long as necessary to render assistance as specified in paragraph III.

F. All other ships (larger than LCT's, LCI's, and LSM's), shall get underway, sortie from harbor, and retire so as to avoid the storm center, in accordance with orders from CTG 10.12. Operate in areas which will be assigned by CTG 10.12 to the various ships.

VI. In time of heavy weather (even aside from typhoons) the Shore Patrol is charged with the responsibility of determining when it becomes impracticable to use the landings at Bikini Island, and shall so notify the Task Group Commander by dispatch. CTG 10.12 shall determine when it becomes impracticable to land boats at other islands of Bikini Atoll. Boat service to islands shall be discontinued when conditions become such that there is danger of severe damage to boats going alongside landings.

ANNEX P

ADMINISTRATIVE PLAN

I. It is the mission of the Administrative Department to provide the material, personnel, clerical, and logistic support necessary for the most efficient work of

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the Bikini Scientific Resurvey Staff. The head of this department will be the Administrative Officer, Commander R.S. Brookings, whose responsibilities are to:

A. Implement the orders and desires of the Project Officer in all matters of administration of the Bikini Scientific Resurvey Staff.

B. Coordinate the administration services of the various Departments of the resurvey.

C. Supervise, through the X-Ray Division Officer, the administration and the work of the X-Ray Division; to the end of providing an efficient and well disciplined organization for the support of the Bikini Scientific Resurvey Staff, and insuring maximum cooperation with the personnel of the ships of the Group.

D. Maintain close liaison among the Task Group Commander, the Project Officer, and the Commanding Officers of the vessels in the resurvey Group, in order to obtain maximum coordination.

E. Organize and supervise an efficient Project Office, in order to maintain accurate records of all military and civilian personnel connected with the project, maintain accurate files of all project business, route communications and correspondence promptly and properly, and provide the clerical assistance required by the Heads of Departments and the Scientific Staff in carrying on the work of the project.

F. Supervise, through the Staff Supply Officer, the work of the Staff Supply Department, in order to insure that the logistic requirements of the project are promptly and adequately met.

G. Plan and carry out a recreation program in order to maintain the morale of all personnel.

H. Establish and supervise the Staff Duty Watch for the protection of scientific equipment and the arranging of services to the Scientific Staff after working hours.

BIKINI SCIENTIFIC RESURVEY
U.S.S. CHILTON (APA-38)
C/O F.P.O., SAN FRANCISCO, CALIFORNIA

COPY

16 July 1947

MEMORANDUM:

From: Radiological Safety Officer.
To : Project Officer.

Subj: Radiological Reconnaissance of Bikini Island and Prayer Island.

1. In compliance with instructions contained in Project Officer Memorandum No. 3-47, dated 14 July 1947, the Radiological Safety Officer, together with three officer monitors, accompanied the Project Officer and Technical Director ashore in the advance landing party at approximately 1200 hours, 15 July 1947, for the purpose of making a radiological survey of those areas of Bikini Island which may be occupied during the initial phases of the Resurvey operation.

2. Since a preliminary survey of the beach in the vicinity of the initial landing site northwest of Beacon D indicated that existent radiation intensities were of the order of 0.004 r/24 hours and well below the established tolerance, four additional monitors were brought ashore, and a general survey of the northwestern tip (map reference 2406) and central sector (map reference 2605, 2606, 2704, 2706) of Bikini Island was initiated.

3. Shortly after the initial landing on Bikini, the Technical Director and one officer monitor re-embarked and proceeded to Prayer Island (map reference 0690) to make a radiological reconnaissance of that area.

4. The general reconnaissance referred to in paragraph 2 above indicated that all of the low intensity radiation encountered on the central sector of Bikini was confined to the sand beaches along the lagoon side of the island and to debris (life rafts, fenders, lines, etc.) which had washed up on the beach. The survey of the northwestern tip of Bikini indicated intensities of approximately 0.03 r/24 hours in algal beds and other scattered localities throughout that sector. Throughout the remainder of the surveyed areas, only background counts were observed.

5. Observed intensities on Prayer Island were not above background, except for scattered pieces of debris which produced readings somewhat above background count.

6. Representative samples of sand, soil, or coral were taken from each sector of the islands surveyed, and have been turned over to the laboratory for analysis and evaluation.

CARL E. GRANT

LTCOL, (Cml.C.), USA.

APPENDIX F

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BIKINI SCIENTIFIC RESURVEY
U.S.S. CHILTON (APA-38)
c/o Fleet Post Office
San Francisco, California.

RESTRICTED
27 August 1947

From: Project Officer.
To: Scientific Staff.

Subj: General Guide on Security of Matters Pertaining to the Bikini Scientific Resurvey.

1. Many of you have asked for advice on what may be discussed concerning the Bikini Scientific Resurvey after completion of your duty and return home.

2. In particular, I refer you to the following pertinent security regulations:

(a) U. S. Navy Regulation, Article 76.
(b) Army Regulations, 380-5.
(c) Atomic Energy Act of 1946, section 10 (b), (which you read and signed when making out your AEC clearance papers).
(d) Joint Chiefs of Staff Security Directive concerning results of Atomic Bomb Tests, dated 21 November 1946, (which is quoted below as an especially applicable directive):

"R E S T R I C T E D

JCS 1552/78
Approved 21 Nov. 1946

SECURITY DIRECTIVE COVERING RESULTS OF TESTS
"A" AND "B", OPERATION CROSSROADS

1. Bomb:
TOP SECRET: Exact methods of placing and exploding the bomb, including the details of any special devices used, shall be classified TOP SECRET. Attention is directed to the necessity of ensuring by all measures the TOP SECRET security of information of the bomb itself, in accordance with current directives of the Officer-in-Charge of the Atomic Bomb Project and with the provisions of the Atomic Energy Act of 1946.

2. Locations:
TOP SECRET: The precise location of the points of burst of the bomb with reference to any other point, including target ships. SECRET: Precise distance relationships between vessels of the target fleet. Approximate distance relationships between bomb detonation points and other locations within a limit of accuracy of one hundred yards. CONFIDENTIAL: Planned precise locations of vessels of the target fleet.

3. Radiation:
TOP SECRET: All precise radiation intensity time-distance relationship records where they are correlated. RESTRICTED: Any expressions of radiation intensities unrelated to time or distance. The existence of alpha

radiation. UNCLASSIFIED: The existence of beta or gamma radiation; qualitative expression of the existence of radiation; i.e., heavy, light, or absent.

4. Radiological Decontamination:
SECRET: Detailed and precise scientific data on this subject. Compiled general data on results proceeding from the use of multiple processes. RESTRICTED: All routine chemical and mechanical processes; information necessary for individual protection.

5. Scientific Observations and Measurements:
TOP SECRET: a. Technical information obtained by instrumentation and minute inspection, such as the relationship between exact distances and pressures, structural strengths, details of damage, effects of shock, radioactivity. b. Exact and detailed methods of measuring results. SECRET: Detailed information obtained from and methods of making assessments of fissions products and alpha hazards in target and operational vessels. CONFIDENTIAL: All other technical and scientific information pertaining to the results of Tests "A" and "B"; planned methods for measuring results.

6. Ship Damage Reports:
TOP SECRET: Final over-all summary report by the Director of Ship materiel. SECRET: Complete consolidated technical reports by groups operating under the Director of Ship Materiel, except for such information as may be required to be classified TOP SECRET by preceding paragraphs in this memorandum. CONFIDENTIAL: Complete technical reports on any single ship provided they do not include material otherwise required to be TOP SECRET or SECRET. RESTRICTED: Individual ship form reports covering damage to ship components or groups of ship components such as pumps and piping, but not covering damage to the whole ship. UNCLASSIFIED: Any qualitative information on topside damage to ships. General information (i.e., "heavy damage", "light damage", "undamaged") on below-decks damage to ships.

7. Report of Task Force Commander:
This report shall be classified TOP SECRET. (The final report of the Evaluation Board will also be classified TOP SECRET)".

3. In general, I urge the use of your own best judgment and discretion in the application of your knowledge and experience gained at Bikini to the best interests of the security of the United States.

/s/ C. L. Engleman
C. L. ENGLEMAN,
Captain, U.S.N.

APPENDIX G

BIKINI SCIENTIFIC RESURVEY
U. S. S. CHILTON (APA-38)
c/o Fleet Post Office
San Francisco, California.

27 August 1947.

From: Medical Legal Board.
To : Project Officer, Bikini Scientific Resurvey.

Subj: Report of Findings, Medical Legal Board, Bikini Scientific Resurvey - Transmittal of.

Encl: (A) Copy of Memorandum, Project Officer, BSR, subj: "Medical Legal Board", dated 15 August 1947, to Staff, BSR.
(B) Report of Findings, Medical Legal Board, BSR, dated 27 August 1947.

1. The Medical Legal Board, Bikini Scientific Resurvey, appointed by the reference attached as Enclosure (A), met aboard the USS Chilton (APA-38) at 2145 hours, 25 August 1947 and at 2215 hours, 26 August 1947, at the call of the Chairman, for the purpose of determining whether any personnel connected with the Bikini Scientific Resurvey have been exposed to radiation exceeding the accepted safe standards.

2. Report of Findings, Medical Legal Board, Bikini Scientific Resurvey, dated 27 August 1947, is transmitted herewith as Enclosure (B).

CARL E. GRANT,
Lt. Colonel, Cml. C., USA,
Recorder.

REPORT OF FINDINGS

MEDICAL LEGAL BOARD, BIKINI SCIENTIFIC RESURVEY

A. Statement of the General Radiological Situation:

1. The radiological survey of Bikini Atoll conducted by personnel of the Radiological Safety Section during the period 15 July 1947 through 26 August 1947 indicated that while certain isolated areas and accumulations of debris washed ashore on the lagoon beaches continued to produce beta and gamma radiation in excess of the tolerance limit of 0.1 roentgen per 24 hours, as outlined in Paragraph 8 (f) of letter, Bureau of Medicine and Surgery, Navy Department, EN10/ Radsafe P2-4, dated 31 January 1947, the residual beta and gamma radiation present throughout the land, beach, and exposed reef areas of the atoll was well within this same tolerance limit.

2. The maximum activity observed by radiological safety officers during the course of this survey was obtained on a deposit of tarry material on a ledge of rock located on the sand spit extending west of Bikini Island. This localized area produced a beta plus gamma reading of 0.6 roentgens per 24 hours, and a gamma reading of 0.18 roentgens per 24 hours.

B. Summary of Radiological Safety and Health Precautions:

1. The radiological safety and health precautions prescribed in the Radiological Safety and Health Annex to the Resurvey Operation Plan were observed throughout the course of the operation.

2. Radiological safety officers accompanied all scientific work parties during the initial landings on islands or areas within the lagoon, and continued to accompany these groups until such time as it had been determined that the area in question was free from any hazardous concentrations of radioactive materials. These officers were equipped with Model 263 Survey Meters, manufactured by the Victoreen Instrument Company, and carried pocket electroscopes or dosimeters to record the accumulative external radiation to which the group was being exposed.

3. Each deep sea diver returning aboard the USS COUCAL (ASR-8) was thoroughly hosed down with a stream of salt water while still on the stage and prior to being taken aboard to insure that all radioactive materials adhering to his suit and associated gear were washed off. Following the removal of his diving suit, each diver and his gear was monitored with a Model 263 Survey Meter by one of the two radiological safety officers stationed aboard this ship to detect the presence of any beta or gamma radiation on either his person or his equipment. Personnel monotoring was carried out aboard the USS Chilton (APA-38) until such time as it had been determined that this procedure was no longer required. Personnel decontamination or "change" stations were established in both the COUCAL and Chilton for the use of personnel in the event that monitoring indicated the presence of excessive radiation on either their persons or their clothing.

4. All members of scientific work parties wore individual film badges during the initial stages of the operation and until such time as it had been determined that this procedure could be modified, or dispensed with entirely, in the instance of areas which had been radiologically cleared. In view of the fact that the deep sea diving and underwater inspection operations conducted on the sunken ships within the target area were considered to be the most hazardous from the

standpoint of exposure to radiation, film badges and pocket dosimeters were carried by each diver throughout the course of this work. Three film badges, each enclosed in a waterproof rubber covering, were attached to the inner clothing of each diver prior to his descent to the bottom; one at chest height, one at waist height, and one in his shoe. These film badges were delivered to the Photodosimetry Unit for developing and analysis at the conclusion of each dive during the early phases of the work, and later at weekly intervals when it had been determined that hazardous concentrations of radioactive materials were not being encountered.

5. Of the total of 517 film badges processed by the Photodosimetry Unit of the Radiological Health Section, no badge carried during the course of the resurvey operations gave evidence of exposure to beta or gamma radiation in excess of the tolerance limits referred to in Paragraph A. 1., above.

C. Summary of Chemical and Biological Studies:

1. Biological studies and investigations carried out during the course of the resurvey operations indicated the presence of varying amounts of radioactivity in the marine life of Bikini lagoon, though not in sufficient concentrations to afford an external radiation hazard. Instructions issued by the Task Group Commander, upon the recommendation of the Radiological Health Advisory Board, directed that no marine life whatsoever would be eaten by personnel attached to the expedition.

2. Recreational swimming at certain designated beach areas on Bikini Island was permitted only after a chemical analysis of the lagoon water indicated a plutonium content of less than 10-11 grams per liter of water. A gross analysis of the fission products present in the water indicated a content of less than 10-12 curies per liter of water.

3. On the basis of the radiochemical analysis of edible fruits taken from Bikini Island, the original ban against the eating of such fruits obtained on Bikini Island was lifted on 24 July 1947 by the Task Group Commander Upon the recommendation of the Radiological Health Advisory Board.

D. Statement of Findings of the Board:

1. In view of the data obtained and the observations made during the period 15 July 1947 through 26 August 1947, the undersigned members of the Medical Legal Board, Bikini Scientific Resurvey, attest, that to the best of their knowledge and belief, no individual assigned to, attached to, or participating in the Bikini Scientific Resurvey operations during this same period of time was exposed to radiation in excess of the established standards.

F. H. RODENBAUGH, Sr., M.D.,
Chairman

G. A. HEFFERNON,
Lt. Colonel, M.D., USA
Member

H. S. Etter

H. S. ETTER,
Commander, (MC), USN
Member

J. H. Roberson

J. H. ROBERSON,
Member

Phillips M. Brooks

P. M. BROOKS,
Member

E. C. Paules

E. C. PAULES,
Lt. Colonel, C.E., USA,
Member

C. E. Grant

C. E. GRANT,
Lt. Colonel, Cml. C., USA,
Recorder

Date: 27 August 1947